



McDONALD INSTITUTE MONOGRAPHS

Temple places

Excavating cultural sustainability in prehistoric Malta

By Caroline Malone, Reuben Grima, Rowan McLaughlin,
Éóin W. Parkinson, Simon Stoddart & Nicholas Vella



Volume 2 of Fragility and Sustainability – Studies on Early Malta,
the ERC-funded *FRAGSUS Project*

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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
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McDonald Institute for Archaeological Research, 2020

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ISBN: 978-1-913344-03-0

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

On the cover: *Digital scan of the Kordin III excavation in 2015, by John Meneely.*

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

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Dedication – in memoriam

John Davies Evans David Hilary Trump

Malta may be small in scale but it has had a rich and important archaeological past which has been explored and enjoyed by many past scholars. A visit to the Archaeology Museums of Malta and Gozo testifies to a long history of collecting, scholarship and passion dating back to the early to mid-nineteenth century. It is a heritage that is beloved by Malta and its visitors alike.

The editors of this volume wish to pay tribute to two remarkable ‘visitors’ to Malta, each of whom, in their own way, made great contributions to our present appreciation of the islands’ ancient past and supported our early researches, teams and ideas. Now we want to record our debt as some of the continuing scholars of Maltese prehistory, since we cannot imagine where we could have begun our current quest to take the story onwards and deeper without their prior work.

On behalf of the whole *FRAGSUS* team, we wish to dedicate this volume to their enduring memory.

Professor John Davies Evans (OBE) (1925–2011) arrived in Malta in 1952 from Cambridge to commence the task of organizing the war-damaged museum collections in preparation for a synthesis of Maltese prehistory. His task was enormous, and involved a new assessment of the pottery and material culture sequence of Maltese prehistory. He prepared his now classic study *The Prehistoric Antiquities of the Maltese Islands*, published in 1971, which has remained the primary compendium of reference to this day. Together with carefully targeted excavations, John Evans set in train the many questions that inspired not only David Trump, his successor, to explore and challenge the com-

plex story of Malta’s prehistoric past, but also ourselves over the last 35 years. John noted important aspects of sequence, material connectivity and, of course, the temples. These he recorded and described in such detail that his work remains vitally important today.

David Hilary Trump (OM) (1931–2016) succeeded John Evans, having already experienced Maltese prehistory in the field with him, and became the Curator of the Museum of Archaeology for five years until 1963. In that short time, he too made an enormous impression on the understanding of prehistoric Malta. His work at Skorba (as we discuss in Chapter 7) was inspired and informed, and it too set the direction for the future explorations of prehistory in the islands. David Trump maintained his interest in Malta throughout his career, leading regular study tours to the island and latterly, with ourselves, undertaking the sustained programme of fieldwork at the Xagħra Brochtorff Circle (1987–9). He wrote numerous books and papers on Malta’s prehistory, popular and academic; and his contribution has been widely acknowledged through museum displays, the award of the Order of Merit of Malta and an Honorary Degree from the University of Malta for which he felt hugely honoured. But back in the United Kingdom, from whence both these scholars came, there has been less mention of their work on Malta. Evans moved eastwards to Crete in his research interests, and has been identified mainly with that work; whilst Trump, a retiring and extremely modest individual, did not promote his achievements on Malta during his teaching years at Cambridge, which was arguably too theoretical to fully appreciate his remarkable contribution.



Figure 0.1. *David Trump and John Evans together at the Deya Conference, Mallorca (c. 1983) (reproduced with permission of Judith Conway, niece of John Evans).*

Acknowledgements

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 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 (Queen's University Belfast – QUB), Laura Cousens (Cambridge University – UoC), Glen Farrugia and Cora Magri (University of Malta – UM), the Curatorial, Finance and Designs & Exhibitions Departments in Heritage Malta (HM) and Stephen Borg at the Superintendence of Cultural Heritage (SCH).

All archaeological excavations described in this volume were carried out using standard methods, in accordance with the policies of the SCH, in particular the guidance given in the document *Operating Procedures and Standards for Archaeology Services – February 2013*. Permits to enable excavation, survey, sampling and study were granted through the SCH and we are especially grateful to Anthony Pace and Nathaniel Cutajar for their unstinting efforts to ensure fieldwork was enabled.

Tač-Ċawla

The Tač-Ċawla excavations were directed by Prof. Caroline Malone, and the crew consisted primarily of students and staff from UoC, UM and QUB, supervised by Stephen Armstrong, Jeremy Bennett and Conor McAdams, with additional supervision from Dr Simon Stoddart, Dr Sara Boyle and Dr Emily Murray. We are also very grateful for Dr George Azzopardi who sought out accommodation for the project, assisted on

site, and with his colleagues in HM enabled access to space for storage, environmental sampling and finds processing in Rabat. John Cremona and his colleagues in the Ministry for Gozo also played an important role in enabling site clearance and facilities at Tač-Ċawla, and in securing the site following our work, with the long-promised surrounding wall. We also acknowledge a great number of local Gozitan businesses, hardware stockists, JCB drivers and cafe and restaurant owners, who supported our work in so many ways.

Santa Verna

The Santa Verna excavations were directed by Prof. Caroline Malone, assisted by Dr Simon Stoddart and Dr Rowan McLaughlin. The crew consisted primarily of a number of students and staff from UoC, QUB and UM, supervised by Stephen Armstrong, Jeremy Bennett, Dr Catriona Brogan and Eóin Parkinson. Dr Evan Hill wet-sieved the soil samples using flotation and the site was sampled for soil micromorphology and geochemistry by Prof. Charles French, Dr Sean Taylor and Conor McAdams. During the excavation, our understanding of the extant megalithic structure was improved by the superb plan produced by Stephen Ashley. Tiomoid Foley conducted a condition survey of the megalithic remains, the results of which were incorporated into an MSc project. Rupert Barker made a short film of the excavations – *A Day on a Dig* (<https://youtu.be/cGNOGpq746I>). Digital laser scanning was undertaken by John Meneely. Individuals whose efforts are warmly acknowledged include Stephen Armstrong, Dr Catriona Brogan, Dr Bela Dimova, Dr Paola Filippucci, Dr Reuben Grima, Laura James, Lottie Stoddart and Dr Sean Taylor, who supervised trenches, organized field assistants and gave logistical support to the running of the project. At Santa Verna, we particularly thank Dr George Azzopardi (HM) for his invaluable logistical

help at the start of the excavations and insightful comments made throughout, and Ella Samut-Tagliaferro, Cristian Mifsud, Mevrik Spiteri and Daphne M Sant Caruana, who accommodated the wet-sieving and flotation operations at the Ġgantija World Heritage site visitor centre. This was facilitated by Prof. Nick Vella and Chris Gemmell (UM), who organized and set up the sieving system. We acknowledge the interest taken in our work by other organizations including Xagħra parish council, Wirt Ġhawdex, and the staff and pupils at Gozo College. Indeed, the *FRAGSUS* team was delighted by the level of interest in the excavations shown by local residents and other visitors to the site. We particularly acknowledge the help, understanding and patience of the residents who offered us the use of their garage to store tools and equipment overnight, and the local farmer who provided gifts of bananas and kindly offered the use of his pumphouse as a tool shed. We especially thank Joseph Attard Tabone for his interest in and support of all our work, especially at Santa Verna.

Ġgantija

The Ġgantija excavations in 2015 were directed by Prof. Charles French, Dr Simon Stoddart, Dr Sean Taylor and David Redhouse, assisted by Stephen Armstrong, Jeremy Bennett, Dr Catriona Brogan, Conor McAdams, Aran McMahan, Eóin Parkinson, Jacob Pockney and Mariele Valci. Flotation of soil samples was undertaken by Dr Evan Hill. Digital laser scanning was undertaken by John Meneely. The field researchers comprised the geophysical survey team in 2014 under the supervision of David Redhouse and Dr Alistair Ruffell with assistance from Jeremy Bennett. Dr Sara Boyle and Jeremy Bennett undertook initial survey of the WC section area in 2014.

We thank especially HM and its staff on Gozo, who enabled access and provided much assistance at this busy World Heritage Site (the most visited ancient site in the islands), namely George Azzopardi, Daphne M Sant Caruana and Nicolene Sagona.

Kordin III

The excavations were directed jointly by Prof. Caroline Malone and Prof. Nicholas Vella, assisted by Dr Reuben Grima, Dr Rowan McLaughlin, Ella Samut-Tagliaferro and Dr Simon Stoddart. The crew consisted mainly of students from UM, who participated as part of their annual training excavation. They were supervised by Jeremy Bennett, Dr Catriona Brogan, Rebecca Farrugia, Dr Reuben Grima, Tore Lumsdalen and Eóin Parkinson. Flotation of soil samples was undertaken by Dr

Evan Hill. Digital laser scanning was undertaken by John Meneely and Jeremy Bennett. We also acknowledge the kind assistance of Fondazzjoni Wirt Artna, the Malta Heritage Trust, who granted access to the site.

Skorba

The excavations were directed by Prof. Caroline Malone and Dr Rowan McLaughlin, who were assisted by Stephen Armstrong, Jeremy Bennett, Dr Catriona Brogan, Emma Hannah and Eóin Parkinson. OSL profiling and geoarchaeological sampling was performed by Prof. Charles French, Dr Timothy Kinnaid (University of St Andrews), Dr Simon Stoddart and Dr Sean Taylor. The site was laser scanned by Jeremy Bennett. We thank HM for enabling access to the site and Dr Josef Caruana and Katya Stroud for supporting the work.

In-Nuffara

The excavations were directed by Dr Simon Stoddart and Dr Rowan McLaughlin, who were assisted by Stephen Armstrong, Stephen Ashley, Robert Barratt, Donald Horne, Katie Hutton, Christina O'Regan and Leslie Torwie. Many thanks to Dr George Azzopardi (HM) and Ella Samut-Tagliaferro (SCH) for their logistical support. John Meneely laser scanned the silos and analysed the volumetric data. We thank Dr Anthony Pace and Nathaniel Cutajar and their staff from the SCH for enabling access to the site.

Post-excavation

The Department of Classics and Archaeology, UM, kindly offered storage space during the project and accommodated the post-excavation team in the sunny courtyard where pottery and finds were studied. We thank Chris Gemmell in particular for his invaluable help throughout the project, but especially in enabling storage of material and access to it for the project team and the logistics on various sites and for his skilled assistance in setting up the flotation processing. In Belfast, Emma Hannah undertook data entry, sample sorting and volume indexing, and Georgia Vince assisted with data entry and logistics and produced many of the excavation plans and section drawings used throughout this volume. She also archived and scanned the project records along with the original Cambridge Gozo Project, and these are now housed in the National Museum of Archaeology, Valletta. In Malta, pottery was studied by Stephen Armstrong, Stephen Ashley, Prof. Anthony Bonanno, Dr Catriona Brogan, Prof. Caroline Malone, Lisa Coyle McClung,

Rowan McLaughlin, Eóin Parkinson and Dr Simon Stoddart. We thank Prof. Nicki Whitehouse for her enthusiastic support and advice on environmental matters. Thin section slides were produced by Dr Tonko Rajkovača of the McBurney Laboratory, Department of Archaeology, University of Cambridge. We are very grateful to Sharon Sultana (Curator) of the Museum of Archaeology for not only housing the study material but also providing access to it in 2017. Stephen Ashley and Prof. Caroline Malone illustrated the pottery and small finds. Dr Catriona Brogan assisted in the production and editing of this volume. We also wish to thank Ben Plumridge, Production Editor, for seeing this and the two companion volumes through the arduous process of publication. Thanks too, to Jason Hawkes (copy editing), Olivia Shelton (references) and Emma Hannah (indexing) for their careful work on the volume.

Permits and access

The *FRAGSUS* team is very grateful to the heritage bodies of Malta, namely HM and the SCH and their officers, who enabled access to sites and provided the

permissions and opportunities to study the buried archaeology. It cannot be over-emphasized just how privileged the *Project* has been in having access to excavate and examine the exceptional sites of prehistoric Malta. Not only is the entire category 'Maltese Temple' protected, but most sites are also inscribed within the UNESCO World Heritage Site listing for Malta. Some readers may wonder why very small trenches and sondages were permitted at all, whilst others may query the value of small investigations. This volume presents a range of scales of study from the small to the large across prehistoric sites and assesses the value of particular data sets that have been collected. Together with Volume 1, which examines the wider landscapes and environments of early Malta, and Volume 3, which examines the bones and lives of the ancient individuals, this volume fills the middle ground – the sites themselves, and we thank all our collaborators and volunteers in this venture. In particular, we thank the willing site assistants, volunteers, surveyors, cooks and illustrators who gave their time and energy to the archaeological work, and we list them below:

Spring and Summer 2014, Gozo – Tač-Ċawla, In-Nuffara, Ta' Marziena, Ġgantija, Gozo landscapes

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QUB	John Meneely	Digital scanning
QUB	Conor Graham	Survey/technical
QUB	Michael Armstrong	Field assistant
Rome	Mariele Valci	Field assistant

Acknowledgements

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UM	Cecilia Zammit Endrich	Field assistant
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UM	Maja Sausmekat	Student training
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Acknowledgements

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Foreword

Joseph Magro Conti

Consider, 5000 years ago you are on one of the smallest islands in the Mediterranean, which has no water sources, dependent on brief winter rain showers, shallow soil patches, with only stone, clay and salt as natural resources, perhaps a few trees and shrubs. How would you live in such environment? This second volume of the *FRAGSUS Project* (2013–18) provides readers with fresh information achieved through high quality scientific research on palaeoenvironmental analysis, radiocarbon dating, human and faunal bone studies as well as on ceramics, lithics, domestic contexts and monuments, fully addressing five main questions targeted by the project. The support of the European Research Council has been transformative in making this new knowledge about Maltese prehistory more understandable and accessible, as a reader will discover throughout this and the other two volumes.

The coming of *FRAGSUS* was a long journey. Twenty-seven years passed since I first met the main protagonists of this project, Prof. Caroline Malone and Dr Simon Stoddart. They left a long-lasting positive impression on me. I was an archaeology undergraduate at the University of Malta in 1993, under the academic guidance of Prof. Anthony Bonanno, with colleagues Nicholas Vella (now Professor, and former Head of the Archaeology Department at the University of Malta) and Dr Anthony Pace (my predecessor as Superintendent of Cultural Heritage). I was on my first archaeological research excavation by an Anglo-Maltese mission at the unique Neolithic mass burial site of the Xaghra Brochtorff Circle in Malta's sister island of Gozo. A couple of decades later I had the opportunity to participate on other research digs in Malta with Malone-Stoddart, this time as part of *FRAGSUS* at Kordin III Neolithic temples in Malta, a site about which I had long endeavoured to raise awareness for its better understanding and management.

The Temple Period is renowned for the monumental megalithic structures (presumed temples) and the associated underground mass burial places, which offer an aura about the Neolithic mindset, belief system, organisation, ritual and physical capabilities in engineering and art. But what should be further intriguing to the reader is another aspect of human life – how the early people lived? What evidence is there for this aspect from the Temple Period? Previously, such questions were largely without much evidence except sporadic discoveries of typical deposits and material culture, but which were very lacking in data to advance site prediction and environmental data collection. The very few huts so far discovered and interpreted as domestic were ephemeral and thus prone to unrecorded destruction during building construction. I was pleased to contribute my knowledge of domestic sites to the publication of the Gozo study in 2009, and delighted to write this Foreword. This work records the next stages of discovery of the inhabitation record of the Maltese islands, most notably at Taç-Ċawla, a site preserved from development by the action of the Superintendence.

In the past fifty years, the Maltese Islands have undergone successive building booms, each significantly endangering Malta's historic environment. In my quest as an applied archaeologist/heritage manager for over two decades at the Planning Authority and for the past two years as Superintendent of Cultural Heritage, I have endeavoured to collaborate with disparate stakeholders to save or mitigate impacts on the fragile remains of the past, and to raise awareness. The findings from *FRAGSUS* will be an especially useful source of information for policy makers, heritage managers, regulatory agencies and conservation scientists in their quest to preserve and understand Malta's past. The study enables them to make informed decisions about future human impacts on the archaeological heritage, mainly caused by



Figure 0.2. *Joseph Magro Conti at Kordin.*

building development on the small island environment and its island society and economy.

This volume is a seminal interdisciplinary study, not only for Maltese prehistory but also a milestone

in world prehistory more generally. As prehistory pre-dates the invention of writing, the approach of *FRAGSUS*'s research agenda turns archaeo-environmental data into 'words' by digging deep into the embryonic matrix of garden soils on which the temples builders sustained themselves. The project can now explain queries about this sustainability, a theme that is still relevant to modern generations. With the use of multidisciplinary and multinational teams of specialists, the study placed innovative scientific approaches at the fore, and addressed silent aspects that go beyond the traditional art-historical basics of Grand Traditions. The investigations into the core essence of life five millennia ago belong to new scientific approaches.

The *FRAGSUS Project* has addressed lacunae and used unconventional approaches in theory and method to obtain robust scientifically-backed results that have filled in significant gaps in the research agenda of Maltese prehistory and beyond. Equally, the results have surely raised many questions for future research agendas. I look forward to further collaboration, and I am eager to see more collaborative projects between Maltese veterans and upcoming academics and our overseas colleagues.

Joseph Magro Conti
Superintendent of Cultural Heritage, Malta
September 2020

Chapter 9

Economy, environment and resources in prehistoric Malta

Rowan McLaughlin, Finbar McCormick, Sheila Hamilton-Dyer,
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Catriona Brogan, Alastair Ruffell, Nathan Wright, Patrick J. Schembri,
Christopher O. Hunt, Simon Stoddart & Caroline Malone

9.1. The environment of early Malta

Reconstruction of the changing environmental context of the human settlement of the Maltese Islands has been a major focus of the *FRAGSUS Project* and readers are referred to the first publication in this series for the full details, against which the evidence presented here can be read (Volume 1, Chapters 2–5 & 11). It is important to note from the outset that much evidence confirms that certain aspects of the environment – particularly soil properties, levels of vegetation cover and surface water – changed considerably during prehistory and indeed subsequently (Fig. 9.1).

9.2. Material resources

9.2.1. Indigenous materials

9.2.1.1. Rock (PC, AR)

The local materials of Malta were always limited in range, but in accessible and plentiful supply. (Volume 1, Chapter 2). The parent rock Limestone, provided ready sources of easily worked building material. The Coralline Limestone whilst generally too hard and brittle to shape (Pedley 1993; Pedley *et al.* 1976, 2002), could be shattered into blocks and slabs that were employed in megalithic construction, employed as hammer-stones and sometimes as rudimentary grindstones. The softer Globigerina Limestone was the stone of choice for worked building stone, and for a variety of other worked objects, such as stone bowls, troughs and figurines, which were chipped and ground from the stone. Both of these materials were available in ample supply, and even today most building work still relies on Globigerina Limestone (Cassar 2010). It is worth remarking that the most prominent features of prehistoric identity in the islands, the monuments, were constructed out of these local materials.

Coralline Limestone and Greensands was widely used for querns and grinders (Pedley 1993; Pedley *et al.* 1976, 2002), and most prehistoric sites produce evidence of ancient objects fashioned from the hard, dense material. The Greensand, however, was not the hardest or best material for querns. Although rare before the Bronze Age (Zammit 1930, 85), the routine importation of lava and other igneous rock, presumably from Sicily or Pantelleria, was the material of choice for grinding, since it did not shed sharp quartz particles that entered the ground food and damaged human teeth (§9.9.1). The evidence from the human remains studied in this project (Volume 3) presents a varied picture of tooth wear. Evidently cereals were ground with local limestone querns, for instance the examples from Taç-Ċawla, which were examined for phytolith residue but without success. Chert is present in several limestone formations in the Maltese Islands and artefacts made from this and other stone objects from the *FRAGSUS Project* sites are described in Chapter 11, Part 2.

9.2.1.2. Soil (CF, AR, RMcL, CH, PJS)

Soils in Malta, before and during its early occupation history differ from those of today. Prior to human colonization, the landscape was a mosaic of steppe, woodland and scrub; it was supported by soils that developed under particular conditions, especially in protected areas such as the sides of *widien*, below the escarpments, and in the larger depressions. Evidence from our excavations suggest the presence of moist, humic and well-developed soils that were progressively thinned and that lost their organic content with time, eventually exhibiting strong signatures of calcification and xerification from Late Neolithic times onwards (Volume 1, Chapter 5). Rainfall and human activity-driven erosion led to the continuing loss of soil from upland parts of the landscape (such as the In-Nuffara Plateau), leading to a thickening of deposits

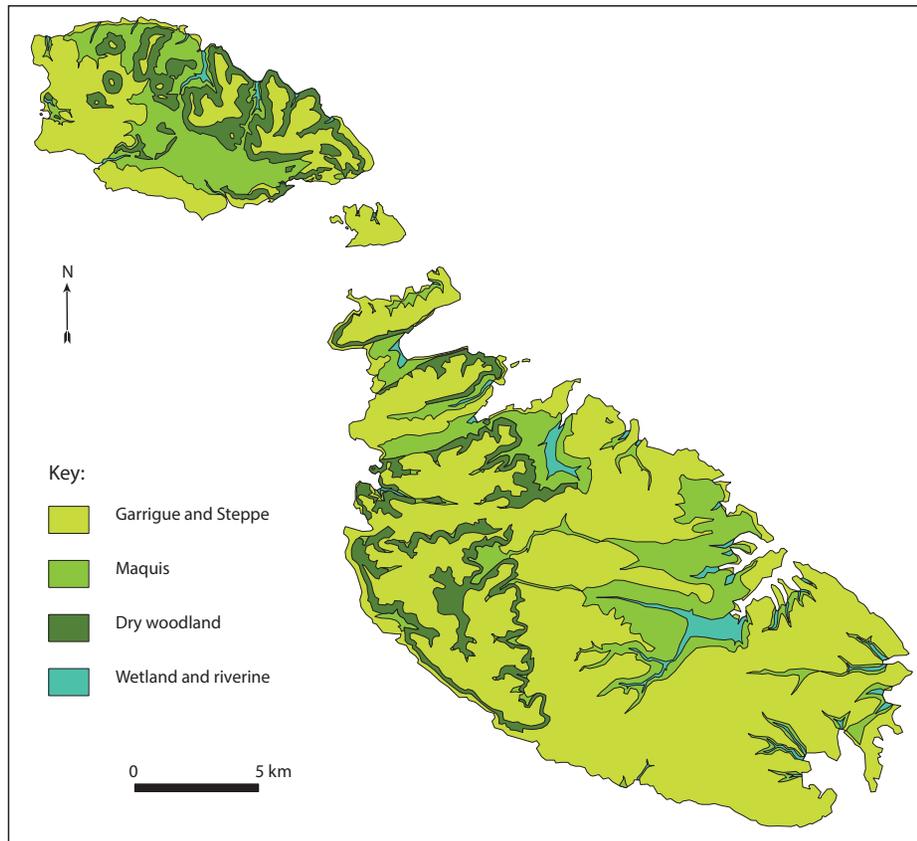


Figure 9.1. Holocene potential vegetation at first colonization, c. 6000 BC. The extent of wetland, dry woodland and maquis would have been somewhat greater during times of high effective moisture, for instance before the 8.2 ka event and during much of the Neolithic and Temple period. Vegetation composition: Wetland and Riverine – reedbeds, bulrushes, and riverine woodland with alder, willow, tamarisk; Dry Woodland – open woodland including oak, pine, juniper, oleaster, phillyrea, hop-hornbeam, maybe other trees; Maquis – scrub with lentisk, juniper, oleaster, phillyrea, cistus, rosemary, privet; Garrigue and Steppe – low-growing scrubby vegetation with thyme, erica, spurrey, rock-rose, centaury, cistus, juniper, and grassy vegetation with a wide variety of herbs.

in valley floors, making these locations valuable for later agriculture (Volume 1, Chapter 2). The loss of soil begins in the very early Neolithic and is a continuing feature throughout prehistoric and historic times, but with some soil conservation practices associated with the development of terraces re-shaping the landscape, probably from the mid-second millennium BC onwards.

The evidence for soil loss is particularly well documented through *FRAGSUS*, since the cores taken from the coastal inlets demonstrate continuing soil erosion throughout the Neolithic. The depth of dated Neolithic sediment carried down to the coast from the interior of the islands can be measured in many metres, for example at Salina, this was up to 14 m in depth, at Salina Bay and Salina 4 boreholes, the depth reached 7 m, at Marsa at least 4 m, and at Xemxija at least 5 m. Such deposition demonstrates enormous levels of soil erosion in the period between the first

human settlement in the mid-sixth millennium BC and the start of the Bronze Age in the second millennium BC. The possible relationship between soil loss and the cart-ruts (Magro Conte & Saliba 2007) of Malta remains a much-debated issue. There could have been active attempts throughout prehistory to drag soil, perhaps laden on timber sledges, or later on wheeled vehicles of some kind, to return eroded soil to the cultivated plots on the plateaux and slopes. By the Bronze Age, soil erosion may have stabilized somewhat, perhaps because so much of the soil cover was already removed, but also because it is possible that a rudimentary terrace system began to evolve in response to soil loss. Where soil was harnessed in the Neolithic, there is evidence that efforts were made to enhance it, with the addition of midden waste, as shown at Ġgantija (Chapter 5.6). Overall, however, there were occasional peaks of erosion that imply

exposed soils in a semi-vegetated landscape, and this is documented by the soil organisms (root symbiotes) and the changing presence of snails throughout later prehistory (§11.2 & 11.5; Volume 1, Figures 11.1 & 11.2). Those peaks were probably associated with episodes of human activity, namely the first impact of agriculture, and then intermittently over time, perhaps coinciding with changing patterns of intensification, extensive cropping, grazing regimes and population pressure. These debates are highlighted in Volume 1, Chapter 11, and in Chapter 12 of this volume.

9.2.1.3. Clay and Ceramics (CB, CM, AR)

The Blue Clay strata that interspersed the limestone geology of Malta were exploited for ceramic production throughout the human occupation of the islands. As discussed below (Chapter 10), recent archaeometric studies on clay sources (Mommensen *et al.* 2006; Pirone 2017; Chapter 10, Appendix A10.2) demonstrate that local clay was exploited, and that a variety of sources of Blue Clay were used. Some sources evidently included greater quantities of shelly material (perhaps from Holocene lagoonal sediments), which is apparent as small white spots in the thin sections of some ceramics, such as the Skorba phase pottery. It is also possible that the shelly material was added by the potter as temper. Other clay mixes included small grit, sand, plant material and dung, and from the local area, silt-grade quartz, carbonate clasts and polycrystalline quartz. Some clay had high levels of precipitated iron or was rich in glauconite that had weathered in the clay and this shows in thin section and may be apparent in the colour of the fired fabric. Clay which was low in iron enabled darker colours, such as the glossy Ġgantija pottery. Potters employed a number of different clays, evidently from various parts of the islands; and these appear to change over time, with a preference for different clay quality for vessels of different scale and function. They also mixed additional temper into the clays which can make some fabric particular diagnostic. Yet, with a limited mineralogical range, there is little to distinguish the material at a chemical level of analysis.

The pottery traditions that developed on Malta drew initially on styles and forms that were in use across Sicily and Calabria. One aspect of early Malta that emerged over the succeeding millennia was how different and individual the pottery styles became during the Temple Period in the fourth and third millennia BC. Much of the argument for distinctiveness and isolation rests on the interpretation of the pottery styles and their apparent identity. As Pirone (2017) has argued, however, the boundaries between Sicily and Malta may have been quite fluid at times, with pottery

made in Malta regularly making its way to sites in southern Sicily, possibly accompanying settlers; but just as possibly forming some type of exchange good, in return perhaps for stone and chert (Chapter 11, Part 2) (Pirone 2017; Recchia & Cazzella 2011).

Pottery was a key component in the successful agricultural exploitation of Malta. It provided vessels for the storage of foods, and probably the conversion of liquid milk into solid and preservable products such as curds, cheese and yogurts. Pottery was also important for cooking and one important contribution by the *FRAGSUS Project* to expanding knowledge of this is in the recording and presenting (Chapter 10) of a range of (to-date) unrecorded coarseware material. The brewing of liquids into preservable drink (ales? beers?) is also quite likely in the context of the evidence for quantities of drinking vessels from temple buildings. By the Middle and Later Bronze Age, domestic vessels were sometimes of very large size, and could have been used for liquid storage (possibly of water) and set within the rock-cut silos, where such pottery has been found (see Chapter 8). Future analysis of lipids and other indicators, such as proteomics, may enlighten interpretation of the rich ceramic assemblage and reveal that some forms, fabrics and stylistic elements functioned for particular activities. Prehistoric potters were evidently skilled and they developed their craft in relation to the raw materials they had locally. They also developed effective ways to fire their pots, some of which were of large size, as shown by the examples from Neolithic to later Bronze Age (§8.7, 8.14, 10.2.4; Chapter 8, Chapter 10). That was quite an achievement given the relatively treeless landscape (§9.2.1.5), and alternative fuels such as dung may have been employed.

Another use of clay was architectural, since clay was a key component of the plaster material used for flooring '*torba*', and roofing '*deffun*'. These materials consist of crushed limestone, mixed with crushed pottery sherds, clay and water and were applied in a particular manner that compressed the paste into a hard, smooth and watertight surface. Almost all the prehistoric structures explored reveal remains of successive floors of the material, and a comparable plaster material was used to level up rough natural limestone bedrock to a level living surface that was safe and hygienic. The practice of making *torba* and *deffun* has extended down to recent times in Malta (Cassar 2010; Checuti 2010, 2005).

The evidence from the domestic structure at Taċ-Ċawla suggests domestic buildings may well have had a considerable and hitherto unrecognized timber element involved in their construction (Chapter 3, §3.4–3.5). Walls made partly of timber or brushwood

would have required a daub coating for waterproofing and wind-proofing, smeared on to wattle-style upper walls. At Taċ-Ċawla the evidence might suggest that timber uprights were set between the internal and external faces of a drystone built base. This plaster daub material was presumably comprised mixed dung, crushed limestone, plant matter and clay. The use of many materials within traditions of domestic construction in prehistoric Malta is logical, but until now, has not been convincingly demonstrated. The Ghajnsielem house, excavated in 1987, also demonstrated the use of clay in the form of mud brick blocks that adhered to the cut limestone base of the structure (Malone *et al.* 1987).

9.2.1.4. Water (CH, RMcL, AR)

With low rainfall and high Mediterranean temperatures (Chetcuti *et al.* 1992), the dry limestone landscape poses challenges of ready access to year-round water supplies. Palaeoecological evidence for perennial streams exists in some lower parts of valley systems, and there is evidence of ample water storage in at least some places on the islands, prior to human colonization, particularly in the *widien* channels. Some *widien* had permanent streams fed from the perched aquifer set beneath the plateau tops, whilst towards the mouth of the *widien*, freshwater wetlands developed (Fig. 9.2), and these became more brackish the closer they were to the coast.

The climate seems to have been wetter during the Neolithic in all but the last phase of the Temple Period. There is good evidence that freshwater resources declined steadily after that period (later third millennium BC), with only a few *widien* still carrying perennial streams and the majority only channelling water during the wet season, and these would have dried up by the second millennium BC (Volume 1, Chapter 4).

Yet, water is a surprisingly available resource thanks to the permeability of the Upper Coralline formations and the Blue Clay aquiclude underneath. Given sufficient rainfall across the Maltese islands in the winter months, there is a guaranteed source of water the year round. In some places, where faulting and erosion have brought the water close to the surface, springs are of key importance, such as the example at Ġgantija, where a fault runs beneath the ‘temple’ complex (Ruffell *et al.* 2018). As Grima (2005) discovered, many prehistoric sites lie much closer to water-related toponyms than would be expected with random location. The Neolithic and Temple Period soils of Santa Verna and Ġgantija on the Upper Coralline aquifer contain evidence for freshwater micro-plankton and there are also signs of dampness in the presence of ferns and bryophytes. Together, these also point to waterbodies close to the sites, whence water-lain silt occasionally made its way into the local soils. Later on, during the first millennium BC, there is evidence from

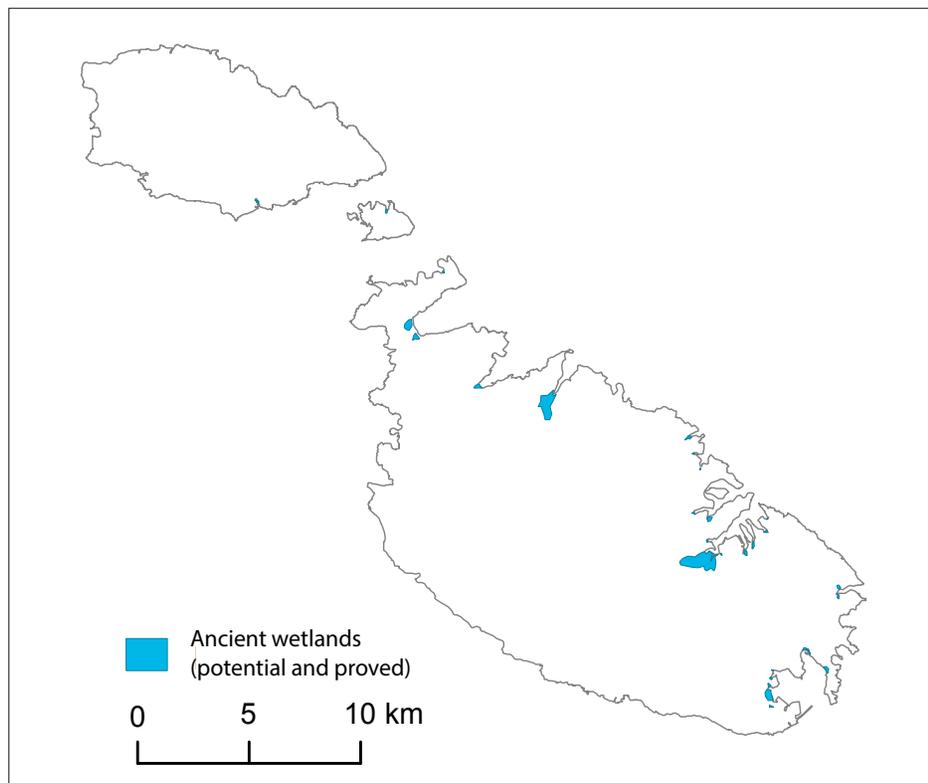


Figure 9.2. Lagoon wetlands map of Malta in the early Holocene.

Tas-Silġ (a Phoenician, Punic and Roman sanctuary site, which had earlier antecedents as a megalithic temple complex; Cazzella & Recchia 2006–7, 2012, 2015) for ferns and bryophytes; indicating local damp conditions throughout the Tarxien phase and Bronze Age, while water lily pollen in a Hellenistic layer is consistent with a pool (Hunt 2015). At Tarxien, the wells on the site penetrate an aquifer close to the surface, whilst at Taċ-Ċawla, the aquifer lay just a few metres below the rock base of the site, and was evidently exploited in the close vicinity of the site (Chapter 3, Appendix A3.7).

Brackish wetlands developed at the mouths of the main *widien* systems, with associated lagoons (Fig. 9.2). Fresh, or almost freshwater bodies existed in some of the lagoons that lay behind the bay-barriers at Marsa, Salina, Xemxija and Santa Maria Bay on Comino, until at least the medieval period. This is indicated by the freshwater molluscs and aquatic plants and non-marine plankton that have been identified in the *FRAGSUS* and earlier Marsa cores (Carroll *et al.* 2012; Volume 1, Chapter 4). The lagoons would have provided a number of resources, including shellfish and fish for prehistoric communities, as evidenced by the molluscs found in the archaeological excavations. Both freshwater and brackish water wetlands would also have attracted birds and it may be that the ubiquitous slingstones from several Neolithic sites (Chapter 11, Fig. 11.5) were used to bring waterfowl down. Interestingly, the use of these stones may be limited to the sixth and fifth millennium BC, since almost none are recorded from later deposits. This could imply the brackish lagoons had ceased to be productive hunting grounds, as they gradually became submerged and salty or infilled with sediment.

9.2.1.5. Wood and other vegetation (COH, PJS, NW)
The natural vegetation of pre-human Malta comprised a mosaic of open vegetation equivalent to steppic grassland and garrigue, with a shrubby vegetation equivalent to maquis, and woodland in sheltered and watered locations with deeper soils. These latter were never extensive, whilst the maquis was probably common over many areas at all times (Volume 1, Chapter 3). Snail evidence supports the idea that open landscapes existed throughout recent millennia, with little evidence for abrupt change between one vegetation type and another (Volume 1, Chapter 4). Importantly, many of the indigenous snails were edible, and could have been collected in different parts of the landscape (Appendix A3.8).

The ubiquity of wood charcoal in most of the soil samples floated from our excavations suggests wood was an important resource. Deciduous and evergreen oak were used as fuel, as were a range of maquis shrubs

(Volume 1, Appendix 9). The presence of *Abies* (fir) charcoal in the Salina Deep Core also speaks of the availability of driftwood, which as a resource may have become more important as the indigenous woodland became depleted and shrubbier (Volume 1, Chapter 3).

A detailed microscopic study was made of charcoal retrieved from the excavated sites, as well as from the environmental cores (Volume 1 and Table 9.1) to identify tree species. The work reveals that local vegetation in prehistory comprised numerous tree species that had value for timber, fodder, fuel and shade. These trees would have also ensured soil stability of parts of the steeper landscape. Santa Verna contained charcoal from both deciduous and evergreen oak, lentisk, pistachio, olive, poplar, and a range of other wood from smaller maquis and scrub vegetation. Kordin III and In-Nuffara both yielded examples of pine as well as oak, pistachio and olive.

There are accounts of charred beams and charcoal strewn over the floor of the ‘Huts of the Querns’ at Skorba (Trump 1966, 48), and several instances of charcoal from likely burnt roof structures at Mnajdra and Tarxien (Evans 1971). From Skorba, wood charcoal was identified from *Cercis siliquastrum* (Judas Tree), *Craetagus* sp. (hawthorn) and probably *Fraxinus* sp. (ash). This was interpreted as fuel, whilst wood ash in the East Temple was interpreted as likely to be from a burnt olive wood roof (Metcalf 1966; Table 9.1). Such wood might well have originated in a plantation of olive trees, grown as much for construction material as for its fruit. Since olive is a low pollen producer, only odd grains occur in the pollen studies, but they do demonstrate its presence. Oak was important and was fairly frequent, whilst poplar appears to be present, if on minimal evidence. The presence of pine and juniper is typical too. Yet, pine would have been scrubby, much as seen today in coastal northeast Libya with its similar climate, and similarly, juniper would have had low level growth. It is possible some wood was actually imported into Malta, perhaps floated alongside rafts or canoes from nearby Sicily, or even found as driftwood washing up on the beaches of Malta. The charcoal also shows the use of shrubs, particularly *Pistacia* – lentisk, and perhaps terebinth. Sheep love its leaves and it has edible oily (though unpalatable) fruits and seeds. Some parts of the woodland/garrigue/maquis environment could provide fodder for animals, including coppiced leaves from oak, poplar and other plants. It is likely that the steeper slopes of the landscape were exploited for grazing during the Neolithic. The pollen data suggest there was a forest of lentisk at or near Burmarrad throughout much of the Neolithic period, and with little or no cereal cultivation. Such a concentration could suggest a semi-managed

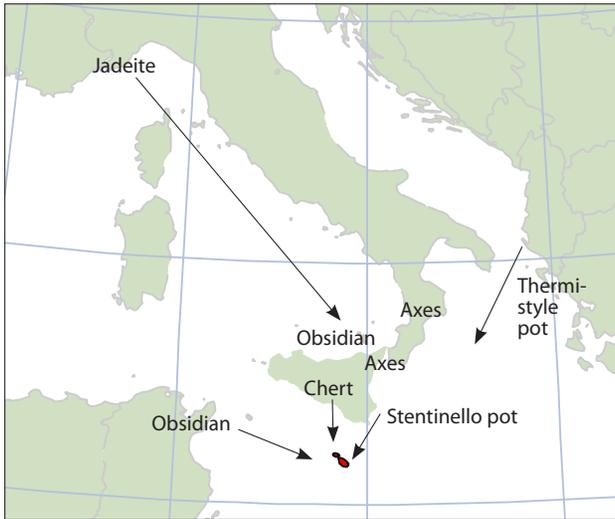


Figure 9.3. Map showing the origins of exotic materials brought to Malta in prehistory.

harvested (coppiced?) woodland, as suggested for Syria (Asouti *et al.* 2015). Active management would appear to be vital for the survival of such plants in the Maltese context. Indeed, this would have been a necessity, given the quantities of fuelwood required for ceramic manufacture and domestic fuel, particularly if dung, the alternative domestic fuel, was being used as a soil ameliorant, as is suggested by the soil analyses. From Roman times until about AD 1000, there was a pine plantation/woodland at Xemxija. This evidence resonates with accounts by Arab geographers, who describe Malta as being a good source of ship-building timber. It is possible some wood was actually imported into Malta. In this category, we can place *Abies* (silver fir), *Betula* (birch) and *Ulmus* (elm). Pollen of the first two are present in our cores (Volume 1, Chapter 3), but in the central Mediterranean these three species are trees characteristic of high altitudes, such as those found in the Sicilian uplands. Large fragments of *Abies* occur in the Salinas Deep core and the most plausible hypothesis for their occurrence is that they arrived as driftwood.

9.2.2. Exotic materials: their origins and distribution

The islands of Malta had a limited range of natural materials available for exploitation in prehistoric times. The most significant of exotic materials were the imported agricultural plants and animals, which must have been brought direct to Malta in the first wave of settlement in the early sixth millennium BC, although thereafter they were locally produced. The evidence for cereal pollen at an early stage (Volume 1, Chapter 3) provides irrefutable proof for this importation.

Unfortunately, the pollen evidence is not yet paired with dated evidence for domesticated animals, but the contemporaneous rise of grazing indicators and spores of coprophilous fungi (characteristic of animal dung) makes it very likely that the first settlers arrived with the typical Neolithic ‘package’ of Near Eastern domesticates (Barker 2006; Bogaard & Halstead 2015; Guilaine 2015; Malone 2015; Price 2000). As this chapter describes, the Neolithic sites investigated by the *FRAGSUS Project* have extracted samples of early agricultural activity that are dated and provide a solid base on which to build stronger interpretation and guide future investigation.

The lack of hard stone for tool making in Malta demanded the exploitation of other sources to supplement the poor local chert supplies. As Chapter 11.5, Part 2, describes, there is clear evidence for the importation of certain chert materials, most likely from Sicily, and from areas perhaps long-known by the immigrants to Malta whose ancestors mostly originated on the larger island and Calabria. Some of the chert came from southeast Sicily, whilst other coloured cherts were sourced from the interior.

Obsidian from the island sources of Pantelleria and Lipari were also of great importance in the lithic assemblage of Malta. From the outset of settlement, the material was acquired and brought to Malta. As our study shows (§11.3) the material is almost always in very small pieces, implying constant reworking until so reduced as to be useless. One important object located at Taç-Ċawla was a Lipari obsidian prismatic core that was incompletely reduced, suggesting on-site knapping took place (§11.3.4). Another important object from Santa Verna was a fine, and uncharacteristically shaped, arrowhead of Lipari obsidian (Chapter 11, Figs. 11.10 & 4.36), one of only very few arrowheads ever identified in Malta. The implication may be that such prestigious objects were made elsewhere than Malta and imported as finished artefacts.

Hard stone for the manufacture of axes has been a theme of past research (Leighton & Dixon 1992; Malone *et al.* 2009, 253–60). The *FRAGSUS Project* located only one complete small ground-stone item, a crude pendant in the survey around Santa Verna, together with some possible fragments of a ground stone artefact (Chapter 11); but the need for hard, crystalline rock was always clear in Neolithic economies. Tree clearance was most likely undertaken in part with stone axes, and other wood working, stone shaping and craft activities also relied on hard stone tools. Neolithic Maltese people evidently imitated the stone grinding and polishing process on local limestone (as revealed in the ‘dummy’ limestone axes from the Xagħra Brochtorff rock-cut tomb (Malone *et*

al. 1995, 2009, Figure 256). Limestone did not have the physical strength or polishing properties to provide a local alternative. The importation of the hard stone appears to have always been quite limited, given that the total numbers of axes recorded amount to perhaps a couple of hundred items, and many of these were concentrated in the funerary sites of Ғal Saflieni and the Xaġhra Brochtorff Circle and the temples. When found in their totality, as at the Xaġhra Brochtorff Circle, where strict sieving of deposits ensured small finds were retrieved, it was clear that few of the objects were functional, having been reworked and reduced to tiny size, and in many instances, converted instead to pendants. This pattern of reduction suggests that far from having a regular importation of exotic materials from Calabria, Sicily, and in one instance, the Maritime Alps, Malta may have actually been excluded from the exchange networks. This exclusion demanded the recycling of rare materials by turning them, in the process, into symbolic and prestigious objects. As noted above (§9.2.1.1), lava was a material that was imported and probably only in any quantity from the Bronze Age onwards. To date, no analysis has been conducted on the precise sources of the fragments retrieved, but in all likelihood, they derive from the Mt. Etna region – or, just possibly, from the Aeolian Islands and Pantelleria.

Metal appears to have been unknown in Malta until the Bronze Age, and no evidence has yet been identified to suggest that raw copper or metal objects were imported during the Temple Period. By the Tarxien Cemetery phase, the importation of firstly, copper tools (the axes from the cemetery at Tarxien) and then later on, bronze objects, follows a process of acquisition and manufacture that was probably similar to that seen in Sicily and the central Mediterranean area. Quite evidently, there was no indigenous metallurgical tradition on Malta, given the complete lack of raw mineral ore, and that situation was possibly similar in Sicily, although recent research implies some exploitation of local ores from the third millennium onwards (Giannitrapani *et al.* 2014).

9.3. Economy and foodways

9.3.1. Introduction: the lines of evidence

Food is central to the lived human experience. Beyond subsistence economy, food can provide structure to people's daily lives, define how social activities are organized, and even play a prominent part in ritual and religion (Appadurai 1981; Fischler 1988; Goody 1982; Hastorff 2016; Messer 1984; Twiss 2012; Smith 2016; van der Veen 2014). We see these patterns of behaviour repeated today with prestige dining, exotic

foodstuffs, elaborate serving equipment and specialized eating 'manners'. There has been much discussion focused on the likelihood of whether similar themes featured prominently in prehistory as well (e.g. Parker Pearson 2003). The case of prehistoric Malta affords the opportunity to study the prehistory of food in a relatively 'closed' system (the islands' isolation prevented the bulk import and export of materials in small seacraft). Prehistoric food remains associated with a rich archaeological and environmental record have, with the multiple coexisting lines of evidence, the potential to shed light on the many questions posed by the *FRAGSUS Project*. The importance of the human-food relationship in the Temple Period in Malta in particular is highlighted by the prominence of food and perhaps feasting using the material culture associated with the 'temple' buildings themselves (Malone 2007, 2018). The evidence for ritualized food preparation and re-distribution to a large community of diners is implied by the formal layout of the temple buildings, and from the rich archaeological materials within them. These comprise astonishing quantities of fine pottery vessels, many of styles that appear to conform to particular shapes that were replicated at different scales (e.g. Evans' shape 40–41 'offering cup' (§10.9.1–10.9.3). Enormous vessels were placed in strategic, visible and probably symbolic locations in the buildings, presumably for the distribution of whatever food/drink they contained (e.g. the huge stone bowls of Tarxien (Fig. 13.17), Xaġhra Brochtorff Circle (Volume 3), and fragments from Santa Verna (Fig. 11.4)). In tandem with this evidence, cooking evidently took place within the buildings, as shown by the circular fire pits at Tarxien and Ġgantija, which were strategically placed on the central or right-hand-side of the main corridor of the building. Ғaġar Qim produced considerable evidence for burning and charcoal in the 1839–40s investigations (Evans 1971, 80–1; Vance 1842), and other sites have also reported deposits of charcoal fragments, sooty soil and animal bones, although there has never been sufficient study to date of butchery or other indicators. Tarxien, in particular, which was excavated with greater care than earlier temple investigations by Zammit (1930), yielded repeated patterns of animal bones and horns; these were often placed on the stone benches or around the apparent 'altars' that gave visual focus to the many internal rooms of the complex (Attard-Mallia 2018; Malone 2018). More recent excavations at Tas-Silġ seem to have recovered similar evidence (Cazzella & Recchia 2012). Together with the imagery of animals in stone friezes and modelled forms, the implication is that food, animals and their consumption were an important activity. Indeed, they seem to have been highly symbolized,

in comparison with many contemporary communities in neighbouring areas, since not only was ‘art’ used to depict the potential ‘food’ subjects, but also, the external installations of the buildings incorporated stone tethering places. These were generally located directly by the entry to the building, in the forecourt, and usually on the left side of the entrance (Malone 2008). Fine examples are known from Tarxien, Ħaġar Qim, Ġgantija, and Mnajdra, and doubtless were also located at other sites which have been less well preserved or examined. Alongside these structures, stone-cut holes that have usually been designated as ‘libation’ holes seem more probably intended to contain wooden posts that could perhaps have displayed the animal skulls that later made their way into the display and rubbish deposits mentioned above.

Whilst animal-based food was evidently important to the festivities of the Neolithic communities who, we presume, came together in and around the impressive building forecourts, cereal foods also played an important role. Many grindstones have been retrieved from all the temple sites, and this in combination with the surprising concentrations of cereal pollen found near sites (Volume 1, Chapter 11) could imply that many aspects of food production, re-distribution and consumption were community-based. Given the potential for food scarcity, and the need for practices that buffered people from moments of food failure, the Maltese temple ‘food culture’ appears to offer a very particular strategy for island survival (McLaughlin *et al.* 2018)

The *FRAGSUS Project* has focused on collecting data from archaeological contexts associated with prehistoric Maltese food production, distribution and collection that are integral to understanding the temple

system. The primary aim for improving the understanding of prehistoric subsistence in Malta, i.e. the nature of agriculture and what people ate, may enable our research to identify possible changes over time, and perhaps link these changes to climate change and its impact on prehistoric landscapes. Although secondary to these aims, we also wished to test a model that might demonstrate society in prehistoric Malta – like societies everywhere, ultimately – was controlled, to a degree, by its access to available food. This model suggests that the ‘temple’ sites, and perhaps the social, or even a religious, elite who presided over them, were central to a system that maintained control over the landscape through a socially – and symbolically (ritually) – motivated population (Bray 2003; Dietrich *et al.* 2012; Hayden 2001; Hayden & Villeneuve 2011; Rosenwig 2007; van der Veen 2007).

There is growing evidence to suggest that the temple buildings were carefully and deliberately orientated towards particular solar and celestial views and events (Barratt 2018; Barratt *et al.* 2018, Lomsdalen 2018; Ventura & Agius 2017). These moments might have coincided with the festivals and carnivals that marked out the annual agricultural cycle – a cycle that followed a prescribed calendar for the slaughter, feasting and social activities that appear to have directed the lives of these ancient people.

The implications of subsistence on the Temple Culture lead us to pose the following questions: did the unique Temple Culture develop first to meet the demands of making a living in a relatively difficult and geographically limited environment? Did it then evolve to maintain and indeed to flourish over centuries as a consequence? Was food central to all this?

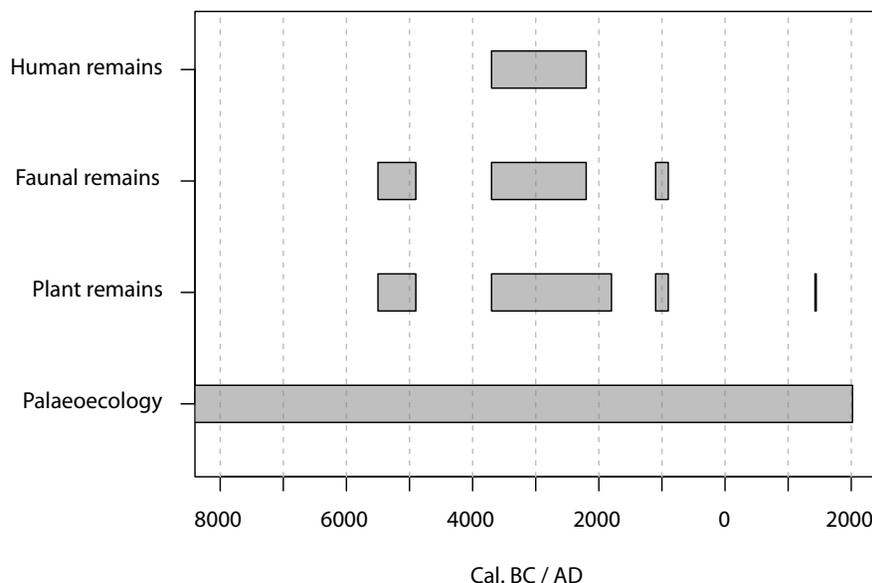


Figure 9.4. The temporal distribution of evidence obtained by the FRAGSUS Project for food, diet and the environment (palaeoecology) in Malta since 8000 BC.

The various lines of evidence for food and diet in prehistoric Malta can be synthesized, and it is important to note that we have not been able to obtain data from every possible source across the long time horizon (Fig. 9.4). Future data collection thus remains an important objective for any future research.

9.3.2. Palaeoecology

Cereal pollen of *Avena/Triticum* type (oats/wheat) and *Hordeum*-type (barley) appear in the Salina Deep Core at the base of zone SDC-06 at 6067–5821 cal. BC (8017–7771 cal. BP). This coincides with the appearance of a variety of coprophilous fungal spores, and a rise of ruderal herbs, both of which are strongly associated with grazing animals. Cereal pollen can be differentiated from the pollen of wild grass on the basis of its size, geometry and surface ornament (e.g. Albert & Innes 2020; Andersen 1979; Joly *et al.* 2007). It is a noted feature of Maltese palynological sequences from c. 6067–5971 cal. BC (8017–7921 cal. BP) (Volume 1, Chapters 3 and 11). It has been reported previously from the Neolithic and Temple Period (e.g. Carroll *et al.* 2012). *Ceratonia* (carob) appears in the Salina 4 core c. 2600 BC in zone SA4-06, but it is present earlier than that as charred wood, in the Early Neolithic at Skorba (Metcalf 1966). Carob produces very little pollen so this is unsurprising. Carob pods were utilized as famine food until late into historic times in Mediterranean countries, but they are much more widely used as animal fodder, and it is likely that grazing animals will have eaten carob pods when they found them, even if they were not cultivated (Volume 1, Chapter 3).

Olea (olive, but also the wild oleaster – we cannot distinguish cultivated from wild forms palynologically) is present from before the Neolithic in the Xemxija core, so we can conclude that oleaster was part of the native flora of the Maltese Islands. The pollen seems to rise and fall with other tree and shrub pollen until the Punic period from c. 400 cal. BC (2450 cal. BP), when olive pollen started to rise and fall with the cereal pollen curve, suggesting that cultivated olive occurred only from the end of the Temple Period (Volume 1, Chapter 3).

Vitis (grape) pollen appears at c. 4750 cal. BC (6700 cal. BP) at Burmarrad (Djamali *et al.* 2013). It is quite possible, given the low pollen productivity of vines, that it was present on the Maltese Islands long before this, as part of the native flora. Wild grapes are, of course, edible; but their presence in the flora is not very good evidence that they were eaten (Volume 1, Chapter 3).

A variety of other taxa present in the pollen diagrams have edible parts, for instance *Pistacia* (lentisk), *Borago* (borage), Brassicaceae (cabbage and mustard

family), *Rubus* (blackberry), *Quercus* (oaks; although most acorns need prolonged soaking to make them edible). Several other taxa are difficult to distinguish palynologically (for instance the Lamiaceae, Apiaceae, Poaceae and Fabaceae have members that have edible parts). It should be stressed, however, that the presence of potentially edible plants does not mean that they were eaten. For that, evidence from macro-remains associated with crop-processing, cooking or latrines is more reliable.

9.3.3. Plant remains

9.3.3.1. Overview and general remarks

Soil samples were taken from all the sites excavated by the FRAGSUS Project. The samples were floated using a Siraf-style flotation machine (French 1971; Nesbitt *et al.* 2017; Williams 1973) with a 500 µm mesh in order to ensure that small weed seeds and chaff as well as large grains were recovered. An average of 10–20 litres of soil per context was our target; however, in many cases, the contexts were too small to achieve this, and less material was collected. The total number of litres per sample is shown in Table 9.1. Samples were floated and the heavy fraction sorted using a field microscope in Malta. The Taç-Ċawla samples were brought to the Pitt Rivers laboratory of the McDonald Institute for Archaeological Research, University of Cambridge and compared with the Institute reference collections by J. Bates using a Leica MZ8 microscope at 0.8x, 1.0x, 2.0x and 2.5x magnification. The Santa Verna, Ġgantija, and In-Nuffara samples were initially sorted by J. Bates in the Pitt Rivers lab through comparison with the laboratory's reference collections so that material could be sent for AMS dating at Belfast. The remaining material was analysed by J. Morales Mateos at the Laboratory of Archaeology in the University of Las Palmas de Gran Canaria (Spain) with reference to the laboratory's seed reference collections for consistency in analysis, using a Nikon SMZ-2T (8x-80x) stereo microscope was used. The Kordin III material was analysed in the University of Las Palmas de Gran Canaria by J. Morales Mateos. The species have been named according to the *Flora Europea*.

Charred plant remains were recovered from soil samples taken from all the sites excavated by the FRAGSUS Project. In general terms, the deposits were not particularly rich in charred seeds, but nonetheless there were seeds in most of them. This outcome is promising, as ancient, open-air sites have generally poor preservation of organic remains. In many cases, the samples were contaminated with modern local flora, but these were easily differentiated from the archaeobotanical specimens as they were not charred

Table 9.1. Charcoal identification of timber from FRAGSUS sites and cores (Nathan Wright).

Taxon/site	SV15 (95)	SV15 (95)	SV15 (90)	SV15 (90)	KRD15 (77)	KRD15 (77)	KRD15 (99)	KRD15 (99)	NUF15 (41)	NUF15 (41)	SDC	SDC	Total*	
	Af	%f	Af	%f	Af	%f	Af	%f	Af	%f	Af	%f	Af	%f
<i>Quercus</i> deciduous spp.	11	10.6	10	23.3	4	3.6			14	9.0			59	13.5
<i>Quercus</i> evergreen cf. <i>ilex</i>	16	15.4	6	14.0	20	17.9			33	21.3			55	15.2
↑ Woodland total	27	26.0	16	37.2	24	21.4			47	30.3			114	28.7
<i>Pistacia</i> cf. <i>lentiscus</i>	31	29.8	4	9.3	21	18.8			39	25.2			95	20.8
<i>Olea</i> cf. <i>europaea</i>	21	20.2	5	11.6	19	17.0	2	100.0	32	20.6			77	17.4
Rosaceae family	1	1.0			11	9.8			20	12.9			32	5.9
<i>Ceratonia siliqua</i>					2	1.8							2	0.4
<i>Cistus</i> sp.	3	2.9							4	2.6			7	1.4
<i>Rhamnus</i> cf. <i>oleioides</i>	12	11.5	3	7.0	3	2.7			4	2.6			22	5.9
<i>Crataegus</i> sp.	3	2.9	1	2.3	5	4.5			2	1.3			11	2.7
<i>Cercis</i> cf. <i>siliquastrum</i>	1	1.0							1	0.6			2	0.4
<i>Ostrya carpinifolia</i>					2	1.8							2	0.4
<i>Carpinus</i> spp.			1	2.3	1	0.9			1	0.6			3	1.0
↑ Woodland sub-dominant and maquis	72	69.2	14	32.6	64	57.1	2	100.0	103	66.5			253	56.3
<i>Tetraclinis articulata</i>	2	1.9			1	0.9							3	0.7
<i>Abies</i> sp.					2	1.8			1	0.6	5	100.0	3	0.6
↑ Conifers total	2	1.9			3	2.7			1	0.6	5	100	6	1.3
<i>Salix/Populus</i>	3	2.9	9	20.9	14	12.5			3	1.9			29	9.6
<i>Ulmus</i> cf. <i>canescens</i>			1	2.3	4	3.6							5	1.5
<i>Fraxinus angustifolia</i>			1	2.3									1	0.6
<i>Myrtus</i> cf. <i>communis</i>					1	0.9							1	0.2
<i>Tamarix</i> sp.			1	2.3									1	0.6
<i>Betula</i> spp.					2	1.8			1	0.6			3	0.4
<i>Laurus nobilis</i> **			1	2.3									1	0.6
↑ Riparian total	3	2.9	13	30.2	21	18.8			4	1.9			41	13.5
NTAXA	11		12		16		2		13		5		21	

or otherwise preserved. These intrusive seeds were discarded and not included in any analysis.

Details of identified plant remains are presented in Appendix A9.1. Images of them are shown in Figures 9.8a & 9.8b. The data enable some general points to be made about the seed assemblages. The greatest quantity of seeds was found at Taç-Cawla (Chapter 3) which was extensively sampled (Appendix A3.3). Similarly, seeds were recovered from the earlier layers at Santa Verna (Chapter 4., Context (90)), which also contained a relatively rich assemblage. In total, 435 seeds and several seed fragments were recorded. Among the crops identified, both cereals and legumes were present. Although both were present, the most frequently recorded cereal was barley (*Hordeum vulgare*)

with the naked variety (*H. vulgare* var. *nudum*) more commonplace than the hulled variety. Naked barley was the variety used in the Neolithic, but is of little importance today (Zohary *et al.* 2012). Wheat (*Triticum* sp.) was also present at Taç-Cawla, Kordin III and Santa Verna, especially the free-threshing *Triticum aestivum/durum*. Legumes were represented by two main crops, lentils (*Lens* cf. *culinaris*) and peas (*Pisum* sp.). The lentil and pea seeds were poorly preserved in general, hampering our ability to identify these with confidence. In fact, the large majority of seeds are fragmented or show damage, with few seeds intact (Figs. 9.7a & 9.7b), indicating processes of erosion and movement of the sediments, and also processing of plants in activities such as cooking (Antolín & Buxó 2011).

Wild taxa were also identified. Grasses were frequent, alongside seeds of the Fabaceae family. This is a group of wild legumes that include several genera such as *Lathyrus*, *Medicago*, *Trifolium*, and *Vicia*, among others, which were, and are, commonly used as fodder, although the seeds can also be consumed by humans (Bullita *et al.* 2007; Butler 1995; Rivera *et al.* 2011). In some contexts, such as the foundation deposit of the Santa Verna temple (§4.3.8, Context 87; Appendix Table A9.1.3), there was a large concentration of wild vetch (*Vicia/Lathyrus* sp.) and other legume seeds, but no crop seeds. This may indicate the use of the plants as fodder, which had been used as domestic fuel or a building material in the form of animal dung (van der Veen 2007). Wild plants are also recorded at Taċ-Ċawla, Skorba, Santa Verna and Kordin III – mostly wild grasses such as *Avena* sp. and *Bromus* sp., which are common weeds in cereal fields. They probably arrived in the archaeological contexts as contaminants of the crops.

In broad terms, Neolithic contexts and non-temple sites had better preservation conditions, with a higher number of remains and seed density per litre of sediment (Tables 9.1 & 9.2, Appendix Table A9.1.1). Taċ-Ċawla in general had more plant remains than the ‘temple’

sites, although it was not significantly richer in crop plants, and the amount of seeds recovered was uneven. Indeed, by far the highest counts of plant remains came from one context, (268) (§3.5.3), in part made up of a large number of wild grass seeds. At the ‘temple’ sites, the seed assemblages from Ġgantija and Kordin III (Appendix Tables A9.1.4a & A9.1.5) were poor compared with those of Santa Verna and Skorba (Appendix Tables A9.1.3 & A9.1.6). At Kordin for example, despite the sampling and flotation of over one tonne of soil, the seed assemblage was limited to only 29 seeds, with no concentrations (Tables 9.2, 9.3). One of the seeds was a grain of charred rice (*Oryza sativa*) recovered from a relatively well-sealed context (Chapter 6, Context (216)). An AMS radiocarbon date was obtained from this grain because of its potential significance – rice may have been introduced during Roman times but this is not certain. In the event, however, the grain proved to be modern in date highlighting the turbid nature of Maltese sediments on ancient sites, and the fact that small items like charred cereals can readily move between strata. This exercise illustrates how AMS radiocarbon dates from charred cereals need to be interpreted carefully, if they are to provide information about the date of the context

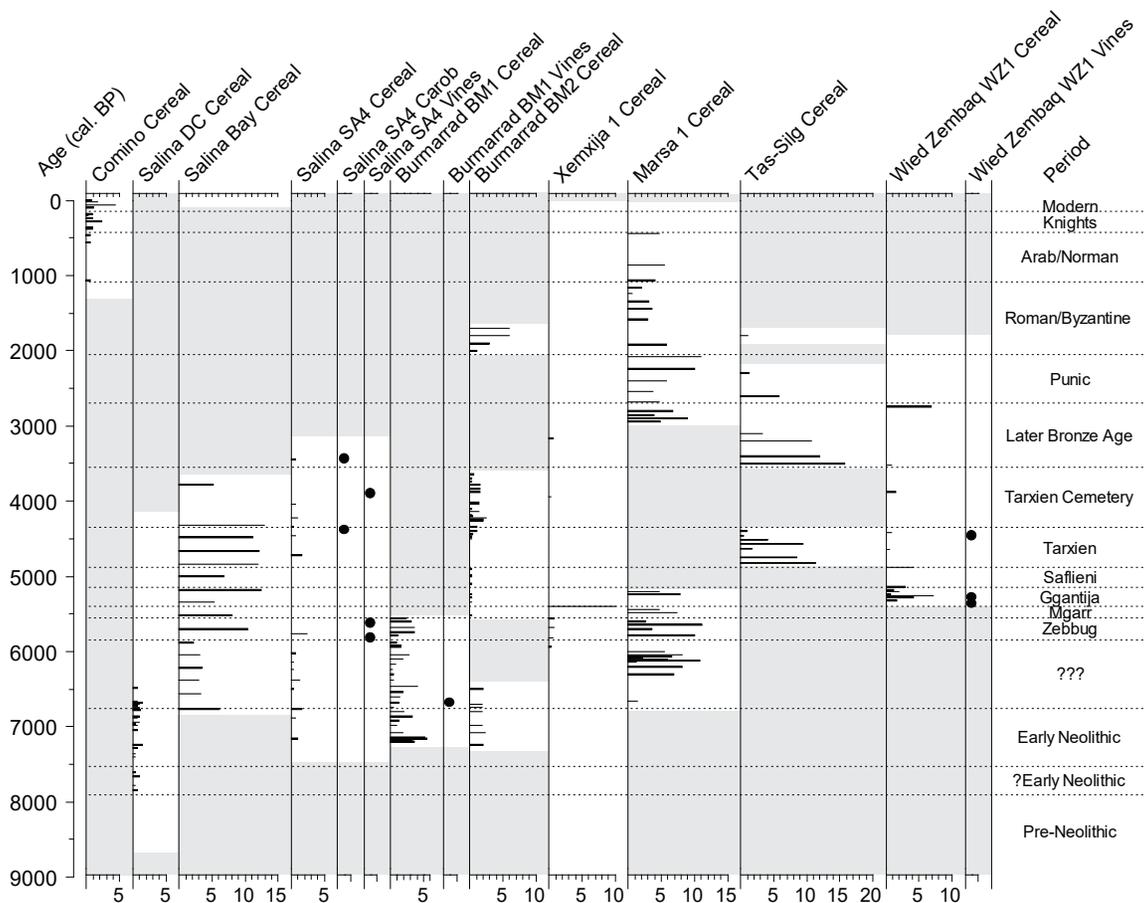


Figure 9.5. The Maltese pollen data over time.

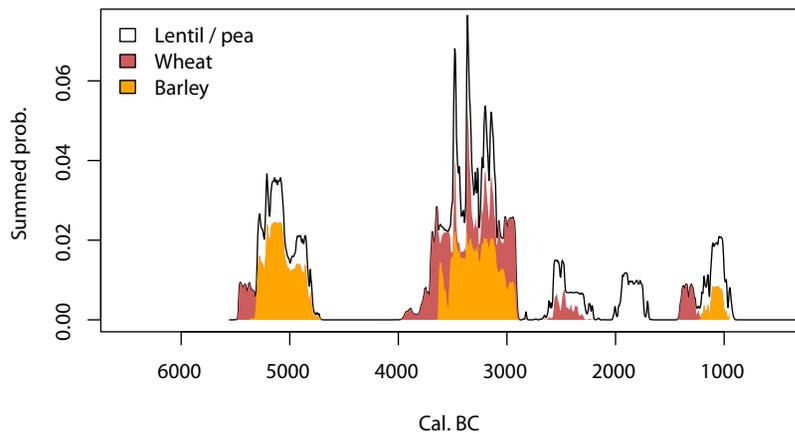


Figure 9.6. The temporal distribution (summed radiocarbon probability) with dates from legumes, wheat and barley added to the plot separately.

where they were found. For this reason, multiple AMS dates were obtained (Chapter 2) for important contexts (Fig. 9.6).

Although the raw number of seeds and the number of seeds per litre of sediment floated varied between sites and between contexts (Tables 9.2 & 9.3), similar plant assemblages were found at all of them, since cereals (barley and wheat) and pulses (lentil and pea) were the only crops recorded. Barley and wheat seem to be the most abundant during all the periods, although the low number of remains at some sites does not allow us to be conclusive in this respect. For wild plants, it is interesting that the highest number of seeds is from

legumes. These species can constitute good food for domestic livestock (Bullita *et al.* 2007; Butler 1995; Rivera *et al.* 2011), so it is possible that some of those seeds arrived on the site as fodder for animals which were kept nearby. Another possibility is that the legume seeds arrived in animal droppings that were used as fuel, a practice common in arid and fuel poor places, or they could be crop processing waste (Fuller *et al.* 2014).

9.3.3.2. Changing patterns of agriculture

Few excavations of prehistoric sites in Malta in the past have undertaken a systematic flotation sampling strategy to retrieve plant remains. Trump (1966) managed to

Table 9.2. Number of seeds recovered relative to the number of samples taken and their volume.

Site	Number of sediment samples processed	Volume of sediment samples processed (litres)	Number of samples containing archaeobotanical remains	Number of archaeobotanical seeds (>1 mm)	Number of seeds per litre	Date range
Tač-Ċawla (Context 268)	7	106	7	3362	31.7	3600–3100 BC
Tač-Ċawla	114	1092	96	1423	1.3	3700–2200 BC
Santa Verna	50	863	37	275	0.83	5500–2900 BC
Ġgantija	13	212	10	19	0.08	2700–2500 BC
Kordin III	67	970	16	29	0.29	3600–2900 BC
Skorba	27	213	20	95	0.44	5300–4900 BC
In-Nuffara	23	763	3	4	0.005	1300–1000 BC

Table 9.3. Ubiquity of cereal and pulse use at the FRAGSUS Project excavation sites. Ubiquity is a measure of the frequency of use or deposition of a plant at a site (see Appendix A9.1 for a full list of seeds retrieved).

Site	Number of sediment samples processed	Number containing cereals	Number containing pulses	% with cereals	% with pulses
Tač-Ċawla	121	57	48	47%	40%
Santa Verna	50	23	10	46%	20%
Ġgantija	13	4	1	31%	8%
Kordin III	67	6	0	8.9	0
Skorba	27	11	3	40%	11%
In-Nuffara	23	3	1	13	4

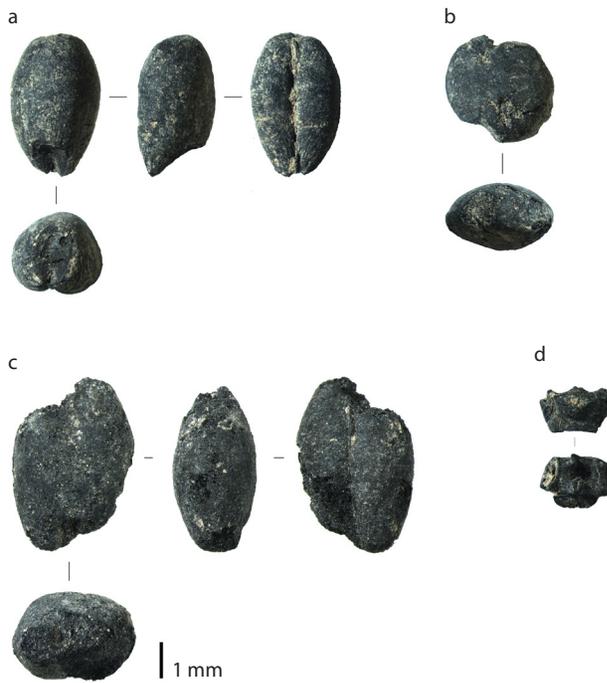


Figure 9.7a. Cultivated plants recorded at the sites: a) *Triticum* sp., grain (wheat, Santa Verna); b) *Lens culinaris*, seed (lentil, Santa Verna); c) *Hordeum vulgare* var. *nudum* (naked barley, Skorba); d) *Hordeum vulgare*, rachis segment (barley, Santa Verna).

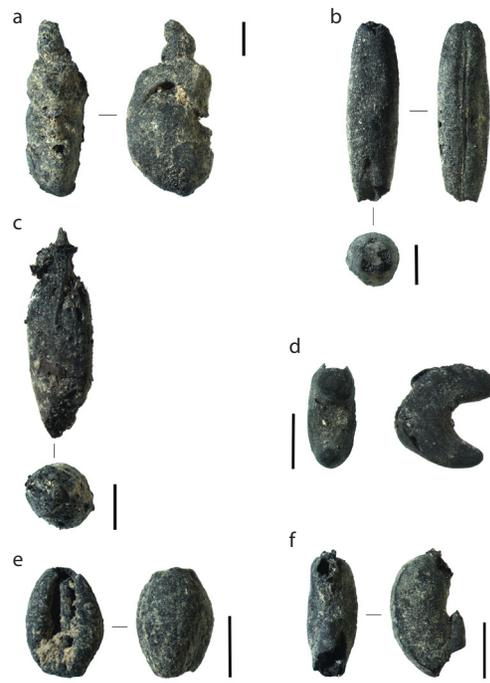


Figure 9.7b. Wild plants recorded at the sites: a) *Fabaceae*, large seeded (Santa Verna); b) *Avena* sp. (Skorba); c) *Erodium* sp. (Santa Verna); d) *Scorpiurus*, (Skorba); e) *Sherardia arvensis* (Santa Verna); f) Small seeded legume (Santa Verna). Scale bar = 1 mm.



Figure 9.7c–d (left and above). Carbonized beans from Tarxien Cemetery (excavated by Zammit) in their museum flask, and enlarged images of selected beans for AMS dating by the FRAGSUS Project in 2018.

retrieve carbonized seeds and wood charcoal from his work at Skorba (40 c.c. barley, 3.5 c.c. wheat, five lentil seeds, one each of Field Madder and Caterpillar weed seeds are listed but not interpreted in the site report, Helbaek 1966, Appendix IV; Metcalfe 1966, Appendix V), but there has been no addition to that initial identification work until recent years. The application of a flotation methodology was only systematically employed in recent years at Tas-Silġ (University of Rome campaign) (Fiorentino *et al.* 2012), whilst the University of Malta has applied flotation, wet sieving and soil sampling to its recent fieldwork focused on Punic and Roman sites. Attempts were made to wet sieve deposits at the funerary Xagħra Brochtorff Circle in the 1980s and 1990s, but given the burial context and harsh alkaline conditions, no surviving samples were obtained. Other than study of the later Neolithic levels at Tas-Silġ and the Skorba campaigns of the 1960s, the *FRAGSUS Project* is the only attempt to explore systematically Neolithic agricultural, subsistence and food strategies in Malta. Any improvement on this overall lack of Neolithic archaeobotanical study is hampered by relatively small assemblages, and the generally poor contextual security of any particular seed.

The archaeobotanical evidence recorded by the *FRAGSUS Project* and its several sites nevertheless constitutes a robust and well-sampled assemblage and provides high-resolution and well-contextualized data to study agriculture and plant exploitation, especially during the Neolithic and the Temple Period. Systematic AMS-dating of seeds has allowed direct information about the chronology of the sites, but also of the plants cultivated during each period (see the distribution of AMS-dated seeds in Fig. 9.4). The crops introduced by the Neolithic colonizers were wheat (*Triticum* sp.), naked barley (*Hordeum vulgare* var. *nudum*), hulled barley (*Hordeum vulgare*) and lentil (*Lens culinaris*), whilst pea (*Pisum sativum*) was only recorded in the Temple Period. This group of domesticated plants is also recorded at other Neolithic sites in the central Mediterranean region (Rottoli & Pessina 2007; de Vareilles *et al.* 2020). Dating of plant remains imply that agriculture along with other Neolithic innovations probably arrived in Malta around as early as 5900 cal. BC as attested by pollen evidence (and from carbonized grain evidence from 5600–5400 cal. BC), at a similar time with other islands in the region (de Vareilles *et al.* 2020).

While our understanding of the Neolithic economy is increasing, our insight into Bronze Age subsistence is still limited. Very few Bronze Age strata, particularly Early Bronze Age ‘Tarxien Cemetery’ levels, were identified on the *FRAGSUS* sites, and therefore limited any sampling. Previously published work from the

Tarxien Cemetery type site (Helbaek 1971; Renfrew, J. 1972) revealed that some of the cinerary urns found there contained a large quantity of beans, *Vicia faba*, in addition to a smaller quantity of barley and lentil (Fig. 9.7c). Two beans from the Tarxien Cemetery from the collection at the National Museum of Archaeology were AMS-dated by the *FRAGSUS Project* to confirm their Bronze Age origin (Chapter 2). It seems that this crop was introduced in the Bronze Age, or at any rate was not present on any *FRAGSUS Project* site from the preceding periods. The assemblage from the later Bronze Age settlement excavated by the *FRAGSUS Project*, In-Nuffara, was small compared with the Temple Period sites, despite intensive sampling and flotation (Appendix Table A9.1.7). This disappointing outcome undermines Trump’s (1962) original suggestion that the ‘silo’ features were underground grain stores, and to a lesser degree the results conflict with other evidence from the In-Nuffara plateau, such as finds of grinding stones (two were found), that could imply cereals were an important aspect of life there. Only two whole grains were present (a barley seed and an indeterminate cereal grain); no wild plants were recorded, although it is possible that those grains came from the sediments washed into the silos, not from the original content stored there.

9.4. Faunal remains: mammal bone

9.4.1. Introduction

Animal bone assemblages were examined from the six excavations undertaken in the *FRAGSUS Project*. Most of these were small in size, except for the settlement site at Taċ-Ċawla, which produced enough material to be able to produce some statistical analysis of some aspects of the data. All of the assemblages were characterized by two consistent features, uniformity and fragmentation. The faunal remains in virtually every context were dominated by the remains of sheep/goat, with cattle and pig remains appearing in smaller quantities. Goat comprised a small percentage of the caprovine remains.

The great majority of the remains were fragmented and unidentifiable. Such bone almost invariably comprised over 90% of the bones in any given context and in some there were no identifiable fragments present. The acute fragmentation posed problems for quantification so it was necessary to define which bones would be counted for inclusion in the tables. The methodology used was similar to that applied by McCormick and Murray (2007), which is in turn a modified version of that outlined by Albarella & Davis (1996). All of the recovered faunal material was examined, but what was generally considered as low-grade information was not

recorded. A narrower range of clearly defined bone elements are counted rather than all the identifiable fragments. The method counts any bone where at least 50% of the diagnostic zone survives. The details of the methodology are provided in McCormick & Murray (2007, 9–11).

9.4.2. Fragmentation

Fragmentation can either occur before or after deposition. Pre-deposition fragmentation can generally be attributed to the deliberate breaking of bones to facilitate marrow and fat removal. Post-depositional fragmentation can result from poor preservation due to soil conditions, trampling or the reworking or redeposition of deposits. In the present assemblages, fragmentation seems to be the result of both factors. Acute fragmentation was also a characteristic of human remains from the Xagħra Brochtorff Circle, which is likely to be the result of disturbance of the remains as new burials were added to the assemblage. Attempted AMS radiocarbon dating of human and animal remains, however, demonstrated a much higher failure rate for the animal bones because of the low collagen content in the samples collected for dating. As the soil conditions were similar, this suggests that the fragmentation had to be accounted for by pre-depositional factors. The most likely explanation is that the animal bones had been boiled prior to being discarded, thus removing much of the collagen from the bone. The intense deliberate fracturing and splintering of mammal bone is also a feature of Neolithic and Bronze Age Greek sites,

although the incidence declines over time (Halstead & Isaakidou 2017, 117–18). The bones from Bronze Age In-Nuffara also tended to be less fragmented than in the earlier Neolithic sites in this study.

9.4.3. Species distribution

The distribution of mammal species and skeletal elements are listed in Appendix Tables A9.2.1, A9.2.17, A9.2.25, A9.2.32, A9.2.38 and A9.2.41. All samples are characterized by rather large proportions of phalanges and teeth – clear indicators of the high degree of fragmentation in the samples. The minimum numbers of individual (MNI) and number of identified specimens (NISP) values from the different assemblages are shown in Tables 9.4 and 9.5. The same values for the main species are shown in Figures 9.8 and 9.9. The assemblages are relatively small and the contexts and phases are amalgamated in these tables and figures. Sub-analysis of the material, however, demonstrated a remarkable uniformity in the makeup of material; they were all dominated by caprovines with smaller number of cattle and pig in each sample.

9.4.4. Sheep/goat

Sheep and goat bones are generally difficult to differentiate, especially when they are so heavily fragmented as in the present context. In some instances, however, identification was possible, and the great majority were of sheep. Appendix Table A9.2.2 lists the diagnostic sheep and goat bones from Taċ-Ċawla; 92% are of sheep. The dominance of sheep on the other sites can also be seen in the caprovine measurement tables (Appendix Tables A9.2.21–23, A9.2.31, A9.2.40 and A9.2.44) where in nearly all instances the great majority are of sheep, with the exception of the small sample from Skorba which produced very few diagnostic elements (Appendix Table A9.2.37). One of the easiest elements that allow differentiation is the horn core but very few of these were present. It may well be that they were removed and treated separately in the carcass (§9.6). Very few bovine horn core fragments were noted.

Given that the great majority of the caprovines were sheep, it is legitimate to try and reconstruct the age-slaughter pattern of that species. Even though most of the bones could not be identified at the species level (especially in the case of immature specimens), the component of goat in the samples is too low to invalidate the analysis. The tooth eruption data for the individual sites are presented in Appendix Tables A9.2.6, A9.2.36 and A9.2.45. Only in the case of Taċ-Ċawla were there sufficient mandibulae to allow analysis on the basis of tooth eruption and wear. The data are presented in Appendix Table A9.6, and are summarized in Figure 9.10. The age at death bands

Table 9.4. MNI percentage distribution, based on Appendix Tables A9.1, A9.17, A9.25, A9.32, A9.38 & A9.41.

	Cattle	Sheep/goat	Pig	Dog	Cat	N.
Taċ-Ċawla	14.3	67.9	14.3	1.8	1.8	56
Santa Verna	9.1	72.7	16.6	4.5	-	22
Kordin III	27.3	54.5	18.2	-	-	11
Skorba	16.7	50	16.7	16.7	-	6
Ġgantija	16.7	66.6	16.7	-	-	6
In-Nuffara	9.1	81.8	9.1	-	-	11

Table 9.5. NISP percentage distributions, based on Appendix Tables A9.1, A9.17, A9.25, A9.32, A9.38 & A9.41.

	Cattle	Sheep/goat	Pig	Dog	Cat	
Taċ-Ċawla	12.1	81.2	6.5	0.1	0.1	1509
Santa Verna	16.6	72.2	10.8	0.4	-	482
Kordin III	15.4	74.5	10.1	-	-	48
Skorba	19.5	61.9	16.8	1.8	-	111
Ġgantija	20.7	44.8	34.5	-	-	58
In-Nuffara	3.7	81.8	9.1	-	-	267

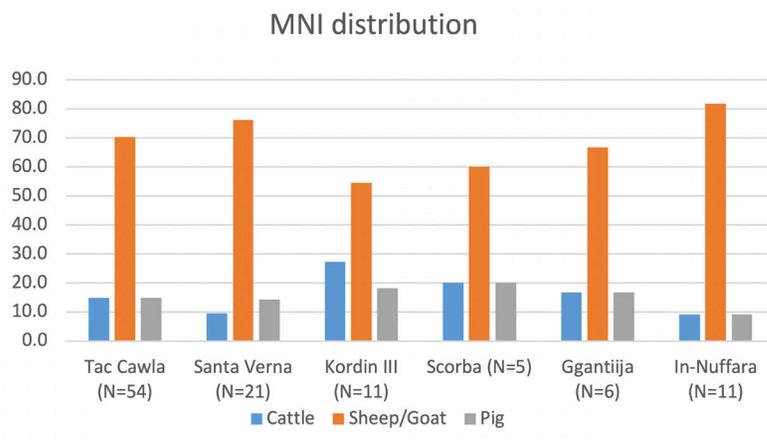


Figure 9.8. MNI percentage distribution, based on Table 9.4.

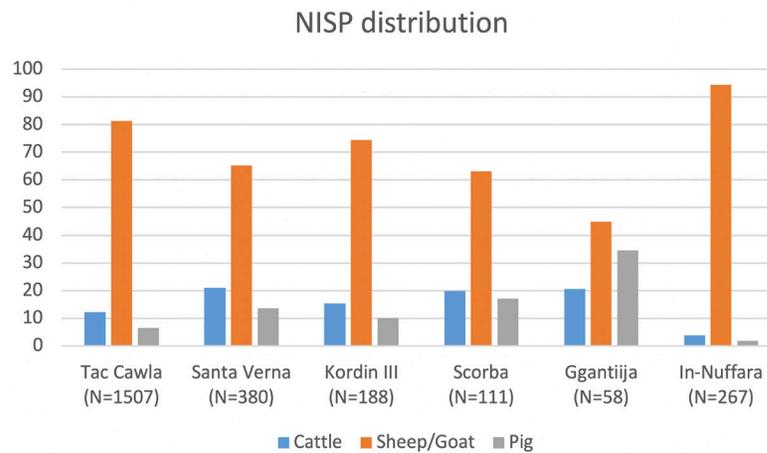


Figure 9.9. NISP percentage distribution, based on Table 9.5.

are approximate, but one can immediately identify a peak in the death of young animals. This is probably an underestimate of the true level of lamb slaughter as there are post-cranial neo-natal bones present, which are not represented in the mandible assemblage.

The assemblages from the other sites produced very few mandibulae and the samples were too small to be of use for reconstructing age-slaughter patterns. The

fusion data for the sheep/goat long bones are recorded in the Appendix Tables A9.2.5, A9.2.20, A9.2.26, 9.2.34, A9.2.39 and A9.2.42. Such data are problematic and sometimes contradictory. The main problem is that they will tend to under-estimate the presence of younger animals since the surfaces of unfused diaphyses would be easily destroyed during the cooking process. Despite these limitations, however, all samples indicate the

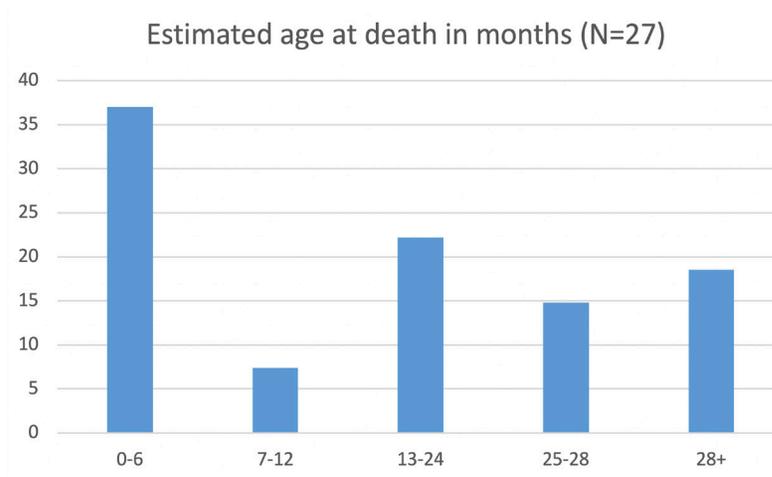


Figure 9.10. Tac-Ċawla sheep age slaughter pattern based on Appendix Table A9.2.7.

slaughter of a high proportion of younger animals. At Santa Verna, for instance, only three out of eighteen (17%) distal metapodia are fused (Appendix Table A9.2.20). The age at which these bones fuse has been found to vary, but Zeder's (2006, 92) study of the various estimations indicate that they generally fuse during the second year of the animal's life, with occasional outliers. These findings would indicate that over 80% of the sheep/goat in our sample were killed off before the age of 24 months. The low incidence of older animals is also demonstrated at other sites. The calcaneus fuses at about the same time as the distal metapodia (Zeder 2006, 92). Although the samples are small it can be seen that at all the sites the majority were unfused.

A high young animal kill-off can be attributed to two factors. Payne's (1973) classic model equated this with dairy production. In this model, young animals are deliberately killed so that the mother's milk becomes available for human consumption. Lipid analysis of pottery from Skorba (Debono Spiteri & Craig 2011) indicates that dairying was being practised during the Neolithic in Malta, as has been demonstrated elsewhere. McCormick (1998) argued that the killing of young animals could be the result of marginal conditions; where there was simply not enough fodder to maintain all of the animals born. A combination of other explanations could explain the high incidence of young sheep in Malta. Halstead's (1993, 66) ethnographic studies indicated that most male lambs were slaughtered in 'infancy' in traditional Greek farming economies, 'partly to avoid competition for resources with valued lactating females and partly because of the high market value of tender young meat'. Additionally, lamb's rennet was necessary for cheese making, which would have necessitated the killing of young animals. The scarcity of fodder could also explain some of the peaks in the slaughter of the animal.

The highest incidence of slaughter among the lambs at Taċ-Ċawla is at about the age of four months. While lambing generally occurs in spring in northern Europe it tends to be earlier in the Mediterranean and the Near East. Early Mesopotamian texts indicate lambing occurred during winter (van Driel 1993, 227–8), while in Roman Italy lambs were generally born between mid-September and mid-December, although some were born in spring (MacKinnon 2004, 117). Late born lambs, however, were regarded as being of less value (Hooper 1967, 333; Varro 2.2.5). This is because winter lambing ensured that lambs were strong enough to endure the heat and drought of summer. Pliny advocated winter lambing as it 'is much better they should be strong before the heat of summer and the long days, than against the cold of winter and the shortest days' (Pliny 8.72.187). The peak in slaughter

at four months suggests a cull in early spring. Varro (2.2.17; also Hooper 1967, 341) notes that lambs were weaned at four months. This implies that excess lambs were ewe-fed until slaughter at this time; and then the ewe's milk, enhanced by spring pasture growth, would become available for human consumption and cheese production.

Late autumn/early winter lambing meant that the ewes had to be pen-fed on fodder for part of the year, a feature confirmed by the Roman writers (MacKinnon 2004, 114). Leaves were particularly important for feeding sheep and Egyptian farming scenes sometimes display scenes of leaves being gathered from trees for fodder. The Saqqara tomb of Nefer and Kahey shows a person plucking leaves and putting them in bags (Altenmüller 1998, 84). Cato (5.8; Hooper 1967, 341) noted 'Cut poplar, elm, and oak leaves betimes, store them before they are entirely dry, as fodder for sheep'. Other Roman writers noted that willow and broom leaves were also used (MacKinnon 2004, 116), and many of these taxa are represented in the pollen and charcoal remains from the islands.

As noted above, sheep greatly outnumber goat in the Malta assemblages. The predominance of sheep over goat is a feature of ancient Mediterranean agriculture. Sheep generally comprise over 80% of the caprovine remains on Roman sites in Italy (MacKinnon 2004, 121). They also predominate in prehistoric Near Eastern sites (Hesse & Wapnish 2002, 475–91). Redding (1993, 88–9) notes that goat tend to dominate during the earliest Neolithic in the Near East, but that after c. 5500 BC sheep begin to dominate. He attributes this to the development of secondary products, i.e. milk and wool. Sheep milk has a much higher proportion of solid/fats than either that of cows or goat.

Goats, proportionate to body weight, produce much more milk than sheep (White 1970, 315) and they can also be extremely hardy. Some Bedouin sheep can be without water for four days (Borowski 1998, 61). Clutton-Brock (1999, 75) notes that goat 'are perhaps the most versatile of all ruminants in their feeding habits'. They are browsers rather than grazers, but their catholic eating habit is also their principal drawback as they can be extremely destructive. Pliny, for instance, noted that they could kill trees (Book 8.76.204) while the Jewish Talmud have laws restricting goat grazing (Borowski 1998, 62). That said, goat would have allowed a more economic exploitation of the resources available in prehistoric Malta as they could browse in woodland and thorny scrubland while the sheep generally grazed the grass. Egyptian depictions of goat show them grazing on bushes or trees (Houlihan 1966, 24–5), as does the famous goat in the thicket stature statuette from the royal cemetery at Ur (Amschler 1937). The

same motif is also occasionally depicted in Roman art (White 1970, plate 71).

The distribution of sheep/goat fragments for the largest samples are shown in Figures 9.11–9.15. As can be seen, all parts of the carcass tend to be represented with high values for small robust elements such as phalanges and loose teeth. A notable under-representation is provided by the horn cores. Some small fragments are poorly represented in all samples. One can conclude that these were disposed of differently from the other elements (see below).

The predominance of caprovines noted on all the present Maltese sites is a feature of many prehistoric assemblages from the Mediterranean and Near East (Hesse & Wapnish 2002, 475–8; Redding 2003 85–8). Çakırlar & Atici (2017, 272), discussing the evidence from Turkey, note that ‘sheep and goat seem to remain the staple resources throughout the millennia’, but that the livestock economy becomes more varied in the later Roman period. McKinnon (2014, 208) has shown that caprovines predominate during early prehistoric periods in the Athenian Agora, but that the makeup of the assemblages become more varied after that. De Grossi Mazzorin & Minitti (2017, 128) noted that the caprovine dominated livestock economy of Bronze and Iron Age Rome gave way to a more varied livestock economy in later periods. These changes were occasioned by urbanism and the commercialization of livestock. In Malta, there is no such change. Medieval urban assemblages (McCormick, pers. comm.) indicate the continuation of caprovine dominance first noted during the Neolithic.

The fragmentary nature of the few horn core samples that were collected makes it difficult to ascertain the type of sheep or goat present. There is no evidence for the horizontal corkscrew-shaped horn type noted in Egyptian (Houlihan 1996, 22–3) and Mesopotamian (Ryder 1993, 27) iconography. The few goat horn fragments were all of the straighter type (Clutton-Brock 1999, 79) and similar to the Tarxien horn cores curated in the National Museum of Archaeology in Valetta (§9.6). The sheep and goat measurements from the *FRAGSUS* excavations are presented in Appendix Tables A9.2.11–A9.2.16, A9.2.21–A9.2.23, A9.2.30, A9.2.40 and A9.2.44. The limited metrical data for caprovine and the other species do not allow useful analysis. Neither is there much comparative material with which to compare the data. The information is, however, presented in the Appendix tables so that it can be used in future studies.

9.4.5. Cattle and pig

Cattle and pig were invariably present in small, but relatively equal, quantities on all the sites (Figs. 9.6

& 9.7). There was slightly more pig at Santa Verna and more cattle at Kordin III, but the samples were small so the differences are probably not significant. The distribution of skeletal elements of cattle and pig samples are generally the same as the caprovines with high values for teeth and, to a lesser extent, phalanges (Appendix Tables A9.2.1, A9.2.17, A9.2.25, A9.2.32 and A9.2.41 and Figs. 9.10, 9.11 and 9.13).

A notable exception is the distribution of pig from Taç-Ċawla the only settlement site amongst all of the sites that were investigated (Fig. 9.17). The incidence of loose teeth is much lower than on the other sites in the present study. The general fragmentation of the bones at Taç-Ċawla was similar to the other sites, so one possible explanation is that skulls were generally disposed of in a different way in comparison with the other sites (see discussion below). The vertebrae of all species were extremely fragmented in the faunal samples and were not included in the tables. The robust caudal vertebrae of cattle should have survived well, but none were noticed in the samples. This would indicate that tails were disposed of differently than the rest of the carcass. A Mesopotamian slaughterhouse account dating to about 2040 BC lists tails of oxen separately from other parts of the carcass (Englund 2003, 2). They may have been used for mundane purposes, such as a fly swatter, but it should be noted that the Egyptian Early Dynastic King Narmer has a bovine tail suspended from his belt on the palette bearing his name (Wengrow 2001, 94), which might suggest a more sophisticated usage for the tail.

The ageing data presented for cattle and pig are extremely limited (Appendix Tables A9.2.3, A9.2.4, A9.2.7, A9.2.8, A9.2.18, A9.2.19, A9.2.27, A9.2.28, A9.2.33, 9.2.35 and A9.2.43) with the most extensive data again discovered at Taç-Ċawla. Both old and younger cattle are present, but there is little evidence for very young calves. The single surviving cattle mandible from Taç-Ċawla is of an old animal with a well-worn third molar. The epiphyseal fusion data is often contradictory. In the case of the calcaneum, which fuses at approximately 36–42 months (Silver 1969, 286), four are fused and nine are unfused. This is contradicted by the distal femur data (c. 42–48 m) where four are fused and two unfused. In general, one could tentatively conclude that most of the cattle were young adult or adult at time of slaughter. Roman agriculturists indicate that cattle in the Mediterranean were bred for traction and their appearance, i.e. their suitability for sacrifice, with meat and milk of secondary importance (MacKinnon 2004, 86; White 1970, 276). That said, not all bovines were raised to maturity, be it for traction, sacrifice or breeding, so immature beef was an important component of the diet.

The pig ageing data were, as already noted, extremely limited with the largest sample again drawn from Taċ-Ċawla (Appendix Tables A9.2.3 & 9.2.7). The site produced two mandibulae, one of an adult (c. 21–23 months) and the other of a young individual (c. 6–7 months). The epiphyseal fusion data indicates that most of the pigs were slaughtered at a young age. According to Silver (1967, 286) the distal humerus fuses at about 12 months. Five of the six distal humeri present were unfused. Fusion data for other bones confirm the bias towards younger animals. Pig are the only one of the main domesticates that are exclusively raised for their meat. They are extremely fecund, so much so that Roman agricultural writers state that the litters were deliberately limited to six or eight to prevent the sow from exhausting her milk supply (McKinnon 2004, 160). This killing off of some new-born piglets might account for a neo-natal humerus present at Kordin III (Context (22)).

9.5. Other species

Only a few fragments of dog and cat were present, with both dog and cat present at Taċ-Ċawla, and dog alone at Santa Verna and Skorba. The cat bone comprised one poorly preserved mandible fragment (L. tooth row 20.4 mm, height of mandible behind M1 12.4 mm). It is difficult to ascertain if such cats were wild, tame or domesticated. In early Egypt, the earliest depiction of a cat in a domestic context, and therefore presumed to be domesticated, comes from an eleventh dynasty (2130–1191 BC) stela (Osborn & Osbornová 1998, 106). The Taċ-Ċawla (Layer 143) bone is from a Neolithic context dating to Żebbuġ-Ġgantija in the second half of the fourth millennium BC, and is therefore most likely to be from a wild cat. This species has also been noted at the Xagħra Brochtorff Circle, where 12 fragments from three individuals were found in apparently Tarxien levels (Barber *et al.* 2009, 332). The Santa Verna and Skorba dog fragments are of medium size dogs. No complete long-bones were present, so it was not possible to estimate the height of the animals. The metrical data are presented in Appendix Table A9.2.46. Dog bones identified at the Xagħra Brochtorff Circle were largely from Bronze Age and later contexts, although 89 fragments from four individuals were in Temple Period deposits (Barber *et al.* 2009, 332).

9.6. Mammal bones: discussion

The animal bone assemblages from the various FRAGSUS excavations were remarkably similar. Each bone sample was heavily fragmented consisting mostly of unidentifiable fragments dominated by compact

skeletal elements, especially loose teeth and phalanges. The distribution of species present was similar on all sites; dominated by caprovines with smaller quantities of cattle and pig. The caprovines were dominated by sheep, but goat was present on all sites. In terms of ageing, there was a high incidence of young sheep slaughtered, which is likely to reflect the importance of dairying. Pigs tended also to be killed at a young age, while most of the cattle appear to have been adult.

In order to be able to reconstruct the livestock economy of early Malta, one needs to supplement the zooarchaeological data with other sources of information. Roman agricultural writers, although considerably later than the sites under investigation, describe livestock farming in a Mediterranean climate that was broadly similar to that of prehistoric Malta. Early Mesopotamian sources also provide valuable evidence about livestock rearing in a hot arid climate. Iconographic evidence from Malta, and beyond, is also a valuable source of information.

The Mediterranean climate, characterized by winter rain and mild temperatures followed by summer drought and heat, makes the rearing of livestock difficult, where the provision of fodder was a particular limiting factor. This must have been particularly so in early Malta where the options for seasonally moving livestock to different kinds of pasture, as in transhumance, were limited given the lack of variability in the Maltese landscape. The keeping of goat and pig allowed the exploitation of marginal areas, but cattle and sheep need good grassland pasture, something that would have been of limited availability as the hot Maltese summer progressed. Indeed, Cato (55.5), discussing cattle in Italy, stated that oxen should only be pastured during the winter, with the implication that they were stall fed for much of the year. Supplementary foods include hay, leaves, mast and legumes (MacKinnon 2004, 87–90). In Mesopotamia, cattle were fed with barley (Nemet-Nejat 2002, 251), while it is also recorded that sheep were fed grain, dates and even bread on a daily basis (Abdalla 1994, 28). Egyptian iconography also depicts cattle and goat as hand-fed, presumably on grain (Darby *et al.* 1977, figs. 3.18a–c). Such supplementary feeding must also have occurred in Malta. This is perhaps demonstrated by the multiple sectioned stone trough from the temple at Kordin III, which could have accommodated seven feeding animals. Its presence in a temple complex might imply that the temples were the owners of estates with herds of livestock, as was the case in Early Egypt, which were sacrificed in large numbers on a daily basis (Ikram 2017, 453). The Kordin trough might be seen in the context of the ‘animal fattener’ recorded in Mesopotamian texts (Postgate 1992, 161).

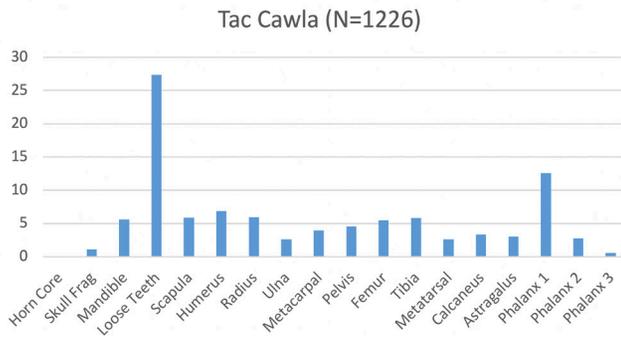


Figure 9.11. Percentage distribution of sheep/goat bones from Tac-Çawla, after Appendix Table A9.2.1.

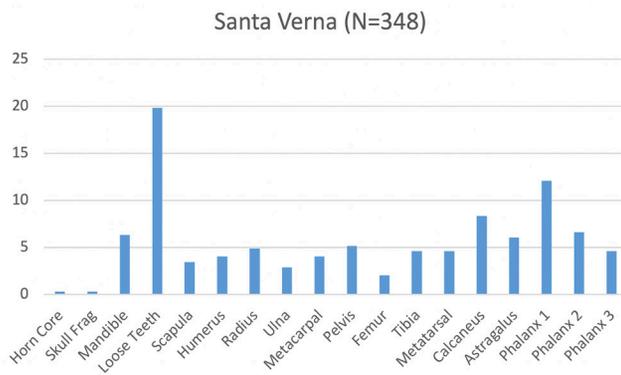


Figure 9.12. Percentage distribution of sheep/goat bones from Santa Verna, after Appendix Table A9.2.17.

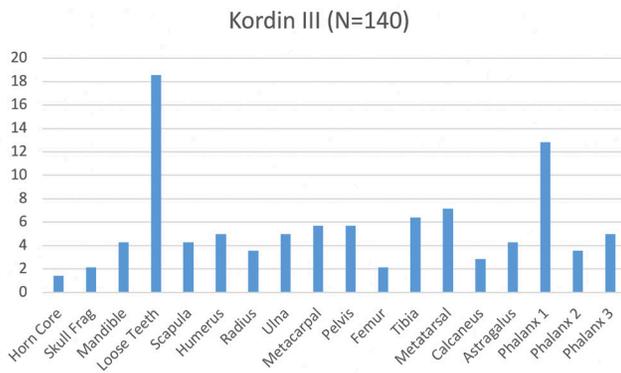


Figure 9.13. Percentage distribution of sheep/goat bones from Kordin III, after Appendix Table A9.2.25.

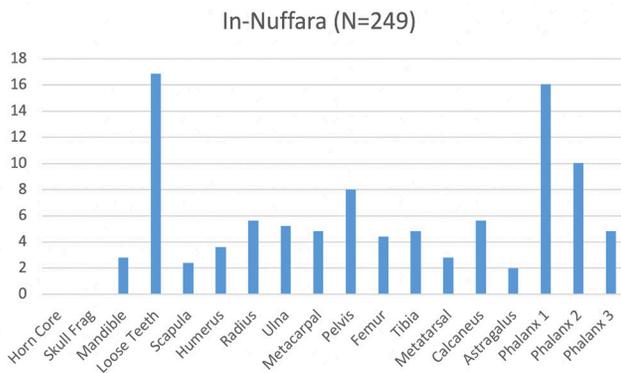


Figure 9.14. Percentage distribution of sheep/goat bones from In-Nuffara, after Appendix Table A9.2.41.

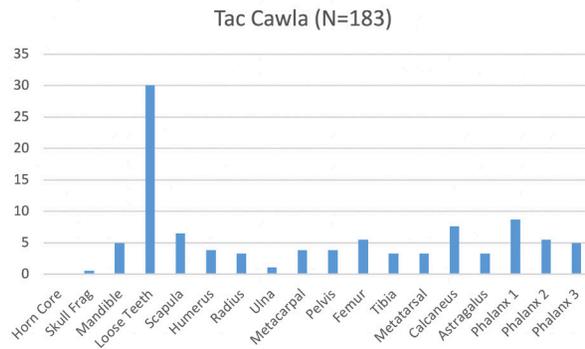


Figure 9.15. Percentage distribution of cattle bones from Tac-Ċawla, after Appendix Table A9.2.1.

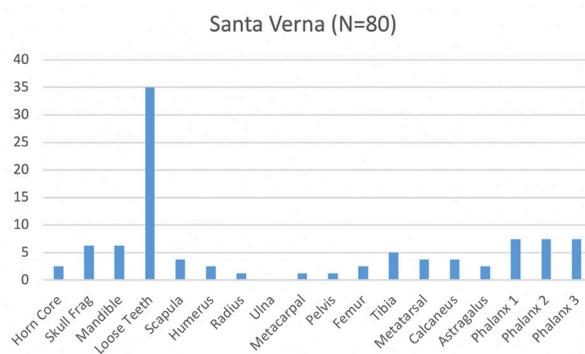


Figure 9.16. Percentage distribution of cattle bones from Santa Verna, after Appendix Tables A9.2.18 & A9.2.24.

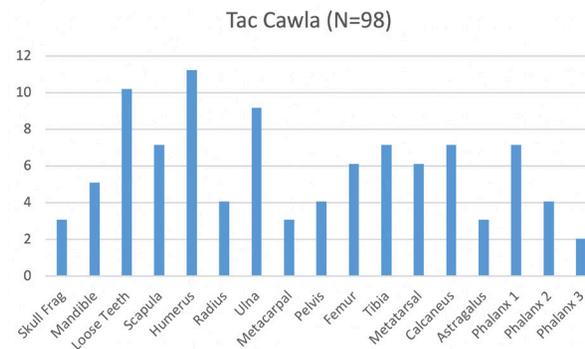


Figure 9.17. Percentage distribution of pig fragments from Tac-Ċawla, after Appendix Tables A9.2.4 & A9.2.10.

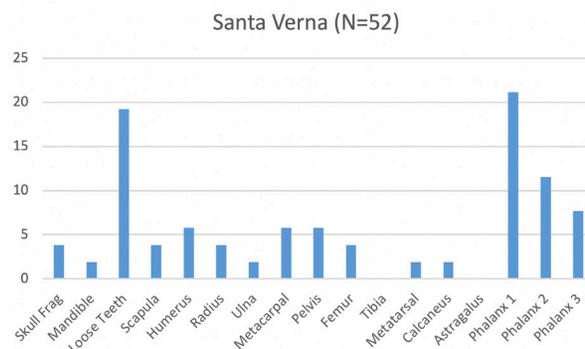


Figure 9.18. Percentage distribution of pig fragments from Santa Verna, after Appendix Table A9.2.19.

Their duty was to feed animals with barley prior to slaughter, and presumably, sacrifice.

Despite the difficulties of raising livestock, farm animals were a necessity for early agricultural societies, since effective arable agriculture could not be maintained without the application of their manure. Additionally, livestock acted as an insurance against crop failure. Such failure was a constant feature of early Mediterranean agriculture, where the main cause was drought. Garnsey's (1988, 8–13) analysis of rainfall in areas of modern Greece indicated wheat failure one year in four, barley failure one year in twenty, while the legume failure rate could be as high as three years in four. Deficiency, as opposed, to failure occurred more regularly. Flannery (1969, 87) noted that early farmers could offset this by either storing excess grain or converting grain into 'live storage' in the form of livestock. Halstead's (1993) study of modern traditional sheep farming indicated that 'banking in livestock' was an integral part of the livestock system, which protected against harvest fluctuation. For the early Maltese farmer, livestock, used in this way, were as much about providing future security, as they were for providing present needs.

9.6.1. *Livestock and religion*

It is impossible to separate livestock from religion in early societies. In Malta, as elsewhere, sacrifice was likely the main vehicle for the distribution of food. In Greece, for instance, there was an 'absolute coincidence of meat-eating and sacrificial practice' (Detienne 1989, 3). This meant that virtually all meat consumed in Roman Greece had been 'sanctified' during the ritual of sacrifice before it was consumed. In early Mesopotamia, the feeding of the gods, and consequent distribution of meat, provided the main vehicle for the consumption of meat (Scurlock 2002, 2006a & b). Ikram (2017, 453) notes that in Egypt the temples were centres of meat distribution in the form of leftovers from sacrifices. The assemblage from the Maltese temple deposits analysed in the present study indicate that they were no different than the settlement site at Taċ-Ċawla. Essentially the deposits from ritual and domestic contexts were the same, which could confirm the observation made by Detienne (noted above).

The question arises as to whether or not the actual slaughter, disembowelling and jointing of the animals took place within the actual temples. This is a messy business, producing blood, excrement and the semi-digested content of animal's stomachs. Ikram (1995, 81–108) considers this question in the context of early Egyptian temples; she concludes (1995, 87) that such activity would have occurred in nearby slaughterhouses, for which there are both extant surviving

examples and representational examples in Egypt. In Rome, representations of 'sacrifice' never depicted the process of killing and dismemberment, again implying that this messy aspect of the ceremonies occurred 'offsite'. A similar situation may have existed on Malta.

Depictions of animals in the early Mediterranean and the Near East take many forms. Root (2002, 173) has divided these into several categories. They can be 'vehicles for experimentation with abstraction and decorative compositional dynamic', 'figures in cosmic contests and performances', 'figures/symbols in emblematic or narrative portrayals of human experience', 'figures/symbols in emblematic or narrative portrayals of the animal world', 'players in specific rituals of human society' or 'signifiers of specific political/social ideas of human society' (Root 2002). Processions of livestock are depicted on two rectangular friezes in the temple at Tarxien. The larger one depicts a procession of twenty-two goats (or possibly sheep) arranged in two registers of eleven. The goats display two horns of different shapes. The longer horns are similar to the slightly twisted horns of domestic goats depicted in fifth and seventh dynasty Egyptian tombs (Altenmüller 1998, 84; Osborn & Osbornová 1998, 188, fig. 13-202). The smaller horn is more curved in form like the curved female goat horns found at the temple and preserved in the National Museum of Archaeology, Valletta. The depiction of the two horn types is consistent in all the animals and it may well be that the sculptor(s) were displaying a hybrid goat of both sexes. The identification of ungulate on the basis of horns was sometimes problematic even in the ancient world. In Egypt, depicted animals are sometimes identified incorrectly in the accompanying hieroglyph label (Osborn & Osbornová 1998, 185). The second frieze of male animals at Tarxien depicts three goats, a pig and a sheep with downwardly curving horns and pronounced tufts of hair between the horns. Ryder (1983, 68) notes of the sheep that it 'has Mouflon-like horns and has been identified by some as a wild sheep, but the horns are comparable to that of a Soay'.

Processions of animals are often depicted in hunting scenes, or scenes of trophies or tribute, but also in what Osborn & Osbornová (1998, 12) refer to as 'offering processions'. This would fall into Root's (2002, 173) category of animal depiction as 'players in specific rituals of human society'. An implicit example of this is the procession of the pig, sheep and bull at the festival of the *souvetaurilia*, described by Cato (141; Hooper 1967, 121), which is frequently depicted in Roman art. Usually the scenes are inhabited by people, but sometimes the animals are displayed alone as in a frieze found in the Roman Forum (Spalding Jenkins

1901, 59). The row of sheep along a lower register on the Uruk or Warka vase (Ryder 1993, 27) could also be interpreted in this way. The friezes at Tarxien are most likely to also represent an ‘offering procession’ of animals to be sacrificed at the temple. The predominance of goat is unusual as Puhvel (1978, 356) has noted that goat is usually low in the animal sacrificial hierarchy noted in early sources. It suggests that the goat held a special place in the religion and ritual of the Maltese temple builders. Perhaps goat, as animals of the ‘live storage’ discussed above, were primarily responsible for saving the Maltese from starvation at some important stage in their history, proportionate to the local ecological conditions.

Cattle are conspicuous by their absence in the Tarxien friezes. Two relief carvings of bulls, however, are present on orthostats in an inner chamber at the site, along with an enigmatic carving that may represent a sow and piglets. A group of long horned cattle are also displayed on a plate from the Ħal Saflieni Hypogeum while a clay model of a bovine was found in the Ta’ Ħagrāt temple (Evans 1971, plate XXXIII, 13), and tiny bull beads were found at Ħal Saflieni (Evans 1971, plate XXVII, 9). Could this indicate that bovines were sacrificed only on very special occasions? It is noteworthy that horn cores of both caprovines and bovines were under-represented in the assemblages from all the sites. It is possible that they were displayed separately as trophies of sacrifices elsewhere in the temples. Zammit (unpublished Field Notes, 1915–19) noted the presence of caches of horn cores at Tarxien (Malone 2018, Mallia- Attard 2018). The pig skulls under-represented at Taċ-Ċawla could also have been deposited in this way. More mundanely, horn could simply have been removed so that the sheaths could

be used for industrial purposes. The Mesopotamian slaughterhouse account, discussed above, itemizes ‘horns of five oxen’ as objects of commercial value (Englund 2003, 2).

Whatever their religious significance, cattle played a vital role in early Maltese society as they were the only species used for traction. Arable agriculture would be extremely difficult without the use of an ard-drawn by oxen, especially when land was left fallow between cultivation. Halstead (1995, 13) noted that various traditional Mediterranean farming sources, including ancient ones, indicate that a plough team could till between 0.1 and 0.3 hectares a day. In contrast to this, the area dug by hand ranged from only between 0.02 and 0.05 hectares a day. Given the amount of food, and water they consume, this significantly increased scale of cultivation must have made the maintenance of cattle stock viable (see Malone *et al.* 2019, Table 1). Experimental archaeology for drawing large stone blocks indicate it is more efficient using cattle rather than human power (Rosenstock *et al.* 2019) and it is possible that they were used during temple building on Malta.

9.7. Birds and fish

9.7.1. Bird bones

A number of bird bones were identified within the faunal assemblages from the FRAGSUS sites and studied separately. Taxonomic identifications were made using the author’s modern comparative collections. All fragments were recorded and identified to taxon and element where reasonably possible. Measurements were taken following von den Driesch (1976) and are presented in Table 9.6. The twelve bones are in mixed

Table 9.6. Bird and fish bone. Measurements (in mm) after Von den Driesch (1976).

Site	Context/layer	Common name	Anatomical element	Bp	SC	Bd
Ġgantija	1042	dove/pigeon	humerus			
Ġgantija	1004	shearwater small	ulna		3.3	7.1
Ġgantija	1041	dove/pigeon	carpometacarpus			
Santa Verna	103	Owl	tarsometatarsus			
Santa Verna	42	Owl	femur			
Santa Verna	53	shearwater small	humerus			
Santa Verna	36	shearwater small	femur		2.8	6.7
Santa Verna	6	shearwater larger	humerus			
Taċ-Ċawla	130	shearwater larger	tibiotarsus		4.3	7.0
Taċ-Ċawla	130	Shearwater	tibiotarsus			
Taċ-Ċawla	238	shearwater larger	humerus			
Skorba	19	shearwater small	ulna	6.1		
Santa Verna	64	grouper	atlas			

condition and none is complete, but all could be identified at least to family and are of four different taxa.

A distal femur from Santa Verna and a distal tarsometatarsus from the same site are eroded but are a good match for owl. The exact species is uncertain but the short-eared owl *Asio flammeus* is probably the most likely and a better match than barn owl *Tyto alba*.

Two bones from Ġgantija, a proximal humerus and a proximal carpometacarpus, can be identified as pigeons. Both bones are damaged, but are probably of wood pigeon *Columba palumbus*. Yet, the slightly smaller stock dove *C. oenas* is not entirely ruled out.

Eight bones match shearwater, including: four bones and an ulna from Skorba 16, a femur from Santa Verna, a humerus from Santa Verna and an ulna from Ġgantija. The size of these bones probably best matches the Mediterranean shearwater *Puffinus yelkouan*. This migratory seabird, once thought to be a subspecies of Manx shearwater, returns to breed on Malta in late winter with the young birds fledging by mid-July (Borg *et al.* 2010). The birds could have been caught at night when they visit the nest burrows in the cliffs in the same way that the closely related Balaeric shearwater was exploited on Fomentara until recently (ACAP 2013). The shaft of the humerus has been shaped to a point and is highly polished. A similar artefact, also from Santa Verna, is of a larger species of shearwater, probably Scopoli's shearwater *Calonectris diomedea*. Two fragments of tibiotarsus from Taċ-Ċawla Context (130) are also probably of this larger species; they are both of the right side and could be parts of the same bone. The final bone is the distal part of a humerus. This bone is porous and probably from a juvenile *Calonectris diomedea*.

9.7.2. Fish bones

The single fish bone recovered at Santa Verna is the first precaudal (atlas) of a very large individual. This best matches a grouper *Epinephelus* sp. of at least 1 m total length. Of the twelve groupers found in the Mediterranean, the two species that most frequently achieve this size are Dusky Grouper *E. marginatus* and White grouper *E. aeneus*. Although these species are considered threatened (Pollard *et al.* 2018) and large specimens are rarely captured today, these fish can reach 1.2 to 1.5 m and weigh up to 20 kg.

9.8. Faunal remains: conclusions

The most notable aspect of the livestock economy of early Malta was its consistency throughout all periods. It would seem that the population discovered the optimal way of exploiting the landscape for the raising of domesticated animals at an early stage and

maintained this from then onwards. It has been noted that the raising of livestock would have been difficult; but at the same time wild food resources, specifically bird and fish, were rarely exploited, a phenomenon that has been noted throughout Neolithic Europe (Schulting 2015), as well as in the island of Tasmania (Jones 1978).

Given the proximity of the sea to all areas of Malta, it is difficult to understand why sea fish were not exploited. The current excavations produced only two fish bones; a vertebrae of a large grouper from Santa Verna and the tooth of a sand tiger shark tooth from Taċ-Ċawla (which may have been prized as an artefact (Taċ-Ċawla, Context (208), SF270) and is not included in the bird and fish bone report above (Fig. 9.19)). Given the paucity of shells from the excavated sites, one wonders if there was a taboo against the eating of fish and perhaps molluscs too (Appendices A3.8 & A6.7.1). Such taboos were noted in some early Egyptian cultic sites, where certain fish were regarded as sacred, but in general fish was an important food source (Simoons 1994, 255–7). A relief carved with fish was found at the coastal temple at Buġibba but the significance is unknown (Evans 1971, plate XIII, 2, 3).

Shearwaters were the most commonly noted bird noted in the small assemblage present. As Hamilton-Dyer has noted above (§9.7.1), these birds can be easily caught in their cliff nests. What is interesting is that two polished pins were made of the humeri of these birds found at Santa Verna (Fig. 11.6). The flattened proximal end of the humerus allowed a good grip of the bones, compared with other parts of the avian



Figure 9.19. Tooth of a sand tiger shark from Taċ-Ċawla, Context (208), SF270.

skeleton, but the fact that both pins are extremely short would suggest that they would have had a specific use. The symbolism of bird bones used as ornament or tool cannot be overlooked, and since the Shearwaters would typically have been trapped, netted or taken from their cliff-side nests, it seems possible prestige was attached to them. Birds did have a special role in the artistic minds of prehistoric Maltese (Malone 2008), as shown by their representation in the Ħal Saflieni and Tarxien bird buttons (Evans 1971, plate XXXVII, 9–10 & plate LI, 7) and on pottery (Evans 1971, plate XLVII, 5 & plate LXIV, 2), and future fieldwork may identify additional species and bone uses.

It is impossible to estimate the relative importance of grain and meat in the diet of the Neolithic Maltese population using animal bones alone; but it is likely that meat was only occasionally eaten, perhaps at special events (Volume 3, Chapter 10). Grain was the basis of the Mediterranean diet in later times (Garnsey 1988; White 1970), and it is likely that it was the same in Neolithic Malta. It is also likely that the consumption of meat was primarily enjoyed by the elite in society. The statement of a late Sicilian nineteenth-century peasant may well reflect the reality of the poor in Neolithic Malta: 'I am fifty years old and I have never eaten meat' (Dickie 2004, 157).

9.9. Human remains

9.9.1. Dental wear

Dental wear is caused by hard particles present within the food that causes micro- and macroscopic damage as food is chewed. It can also be caused by habitual, hygiene-related and sociocultural practices such as craft activities where items are held in the mouth. At the Xagħra Brochtorff Circle, during the Tarxien phase, cases of extreme wear were relatively rare, occurring in less than 3% of the teeth in each context studied, and probably were of a non-dietary origin (Volume 3, Chapter 4). That said, the relatively unworn status of a significant quantity of the permanent dentition indicates a diet that is relatively soft and free from abrasives, by prehistoric standards.

The prevalence of dental caries is, by contrast, rather high; early in the Tarxien phase this approached 12% before falling to around 4% after 2500 BC (Volume 3, Chapter 4). This suggests a diet rich in simple sugars or carbohydrates, such as fruit, honey and processed cereals, although other biological and demographic factors could have also had an effect.

The important question of whether the diet was sufficiently nutritious can be addressed by palaeopathological data. From 2500 cal. BC, enamel hypoplasia increases, which indicates more frequent episodes of

nutritional or pathological stress or trauma whilst teeth were forming in childhood (Volume 3, Chapter 4). Significantly, this signal of increased stress occurred simultaneously with the caries rate decrease, hinting of a population that had more hunger in childhood and less access to prestige food. More broadly, this all occurred as the population at Ġgantija were laboriously supplementing soil in an ill-fated bid to counteract long-term trends towards aridification and lower soil fertility (Chapter 5) and the islands was entering a phase of demographic decline (§2.3.12). This was clearly a moment of stress and a turning point in the economic history of the islands that drew the once productive Neolithic system of agriculture to a conclusion.

9.9.2. Stable isotopes

The *FRAGSUS Project* completed a study of palaeodietary isotopes from Xagħra and Xemxija, adding to the corpus of previous work (Richards *et al.* 2001; Stoddart *et al.* 2009). This method reveals valuable information about diet and agricultural practices in the past that is difficult or impossible to obtain from other sources. This is achieved by looking at the isotopic content of human bones and tooth roots, which reflects the food consumed as this tissue formed. The results are more fully discussed elsewhere (Volume 3, Chapter 10) but the main points are addressed here. Carbon isotopes from Temple Period humans from both sites provide no evidence whatsoever of marine protein in the diet. This may be surprising in the context of a relatively small islands, but is a typical finding for prehistoric agriculturists (Richards *et al.* 2003) and in general agreement with the scarcity of fish bones at the sites (§9.8). Fish and other marine sources of food (molluscs, seaweeds, sea birds) may have been eaten frequently, and indeed the ubiquity of limpets on the sites suggests this may have been the case, but not in volumes that contributed significantly to the bulk of dietary protein. Similarly, C4 pathway foods such as millet were not part of the diet. Nitrogen-15 isotopes from Xagħra Brochtorff Circle are rather enriched compared to Neolithic and Bronze Age populations from Sicily and peninsular Italy. At face value this suggests a diet rich in meat, but it is also likely to be a function of aridity and soil development as the effect is also present in samples of herbivore fauna we have analysed. There is evidence also that the nitrogen-15 enrichment in humans (but not animals) declines significantly with time during the Tarxien phase, which might in-turn reflect a long-term decline in meat and/or dairy consumption. In general, however, variation in the isotopic data is slight and consistent with the food sources evidenced by the botanical and faunal remains at the sites.

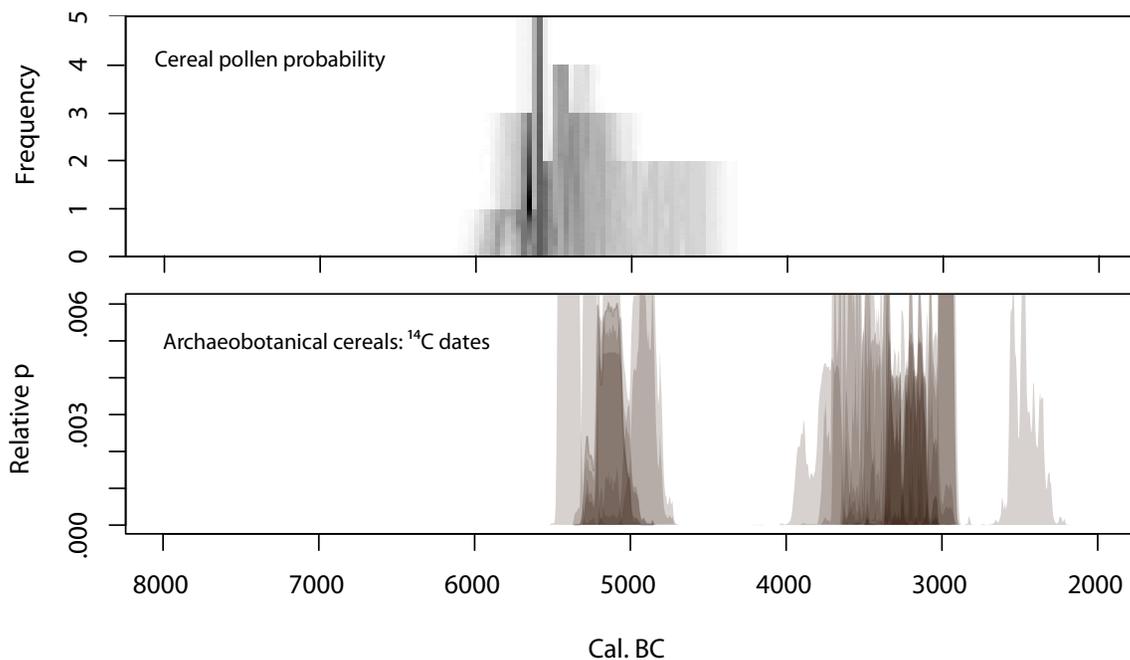


Figure 9.20. Graphs of cereal detection probability for the arrival of agriculture (it should be noted that cereal pollen continues to be present after this initial event). The uppermost graph is a 'ghost' plot (cf. Blaauw & Christen 2011) for cereal counts in the Salina Deep Core; the bottom is radiocarbon dates of cereals from our excavations.

9.10. Conclusions: the economic basis of prehistoric Malta

Arguably the most important economic and environmental event that ever occurred in the islands of Malta was the introduction of agriculture, without which, any sizeable human population density would have been unsustainable (Malone 1997–8). This was a significant event in any context, but in Malta in particular the ancient, rich but unstable soils were already displaying signals of their fragility, which made them particularly susceptible to erosion and other forms of damage once agriculture was introduced (Volume 1, Chapter 5). A key question, therefore, is when this occurred. Palynological evidence from the 30 m Salina core (Volume 1, Chapter 3) suggests that cereals were being grown in Malta shortly after 6000 cal. BC. As discussed in Chapter 2, that cultivation pre-dates any secure, sealed archaeological deposit from our excavations; but its presence has been robustly estimated using the radiocarbon evidence from the core in a Bayesian model of sediment accumulation. In Figure 9.20, the height of the histograms represents the pollen counts; the density of the pixels represents the probability that the pollen dates to a given point in time. In the lower graph, individual calibrated probabilities of AMS-dated cereal grains

are over-plotted, so the density of the image reflects the number of cereal grains dated by the *FRAGSUS Project*. There is a lag of around 500 years between the two, indicating that the palaeoecological evidence for cereal agriculture pre-dates the archaeological evidence. This apparent discrepancy should not necessarily be surprising, since at Taç-Cawla (Chapter 3), Santa Verna (Chapter 4) and Skorba (Chapter 7) the ceramic evidence suggests our excavations did not reach intact strata from the so-called Għar Dalam phase – the earliest stage of the cultural sequence. Furthermore, as discussed in Chapter 2 and elsewhere (Volume 1, Chapter 11), a 6000 BC date fits better the evidence from Italy and Sicily (Natali & Forgi 2018). This was an important episode in the expansion of the Neolithic more generally, and Malta fits well into a pattern of western expansion of the Neolithic economy by pioneering, sea-faring agriculturists. In common with neighbouring Mediterranean agriculturalists, this production system was focused on terrestrial resources, particularly barley and sheep, as far as the evidence so far suggests.

Over subsequent millennia, the archaeological record suggests much cultural change, but a remarkably stable pattern of agriculture. The degree of variability from site to site, and from context to context is very limited, especially in terms of the

faunal remains. This likely reflects aspects of climate and environment in Malta. There was only one way to make agriculture 'work' in an environment of highly seasonal rainfall and summer especially. The availability of freshwater all the year round must have been key for growing crops and securing a supply of fodder. The soils of Santa Verna and Ġgantija contain ferns and bryophytes suggesting stands of fresh water nearby (§9.2.1.4), which in turn suggests some form of irrigation was being carried out, even if this was as basic as manually pouring water from a permanent pool during dry weather. The importance of a water supply is also amply demonstrated by the successive waves of settlement at Tač-Ċawla.

Interpretation of the fluctuating evidence for the intensity of economic practices is a matter for debate. Pollen evidence suggests continuity, or perhaps certain intensification or certainly reorganization, during the fifth millennium BC (Volume 1, Chapter 3), whereas the archaeological record is empty. There are even hints at a downturn in the scale of arable agriculture in the middle Temple Period, around 3000 BC. This can be inferred from the archaeobotany, the pattern of AMS

radiocarbon dates (Fig. 9.18) and in several pollen cores (Volume 1, Chapter 3), although the chronological resolution is generally too coarse to allow close dating.

Whereas the direct subsistence evidence reported here suggests the *longue durée* patterns of Maltese agriculture, we have to turn to other evidence (§9.9.1) to detect the stresses on the human populations that contributed to the end of the Temple Period. Equally, we have to turn elsewhere, towards other evidence that indicates the changes that followed the Neolithic (Volume 1, Chapter 7). These include the systematic introduction of Mediterranean tree crops (vine and olive) and techniques such as terracing, which expanded the use of the landscape, as well as a substantial increase in connectivity, which ultimately affected food supply as much as other sectors of island life. We attempt to marshal these many data and their interpretation and scrutinize them against the original *FRAGSUS* questions in Chapter 13, Table 2, with the aim of addressing how the economic adaptations and evolution of prehistoric Malta underpinned the core questions of subsistence and survival in the small island environment.

Temple places

The ERC-funded *FRAGSUS Project (Fragility and sustainability in small island environments: adaptation, culture change and collapse in prehistory, 2013–18)* led by Caroline Malone (Queen's University Belfast) has focused on the unique Temple Culture of Neolithic Malta, and its antecedents and successors through investigation of archaeological sites and monuments. This, the second volume of three, presents the results of excavations at four temple sites and two settlements, together with analysis of chronology, economy and material culture.

The project focused on the integration of three key strands of Malta's early human history (environmental change, human settlement and population) set against a series of questions that interrogated how human activity impacted on the changing natural environment and resources, which in turn impacted on the Neolithic populations. The evidence from early sites together with the human story preserved in burial remains reveals a dynamic and creative response over millennia. The scenario that emerges implies settlement from at least the mid-sixth millennium BC, with extended breaks in occupation, depopulation and environmental stress coupled with episodes of recolonization in response to changing economic, social and environmental opportunities.

Excavation at the temple site of Santa Verna (Gozo) revealed an occupation earlier than any previously dated site on the islands, whilst geophysical and geoarchaeological study at the nearby temple of Ġgantija revealed a close relationship with a spring, Neolithic soil management, and evidence for domestic and economic activities within the temple area. A targeted excavation at the temple of Skorba (Malta) revisited the chronological questions that were first revealed at the site over 50 years ago, with additional OSL and AMS sampling. The temple site of Kordin III (Malta) was explored to identify the major phases of occupation and to establish the chronology, a century after excavations first revealed the site. Settlement archaeology has long been problematic in Malta, overshadowed by the megalithic temples, but new work at the site of Taċ-Ċawla (Gozo) has gathered significant economic and structural evidence revealing how subsistence strategies supported agricultural communities in early Malta. A study of the second millennium BC Bronze Age site of In-Nuffara (Gozo) likewise has yielded significant economic and chronological information that charts the declining and changing environment of Malta in late prehistory.

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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: 978-1-913344-03-0

