

A view from the countryside: pollen from a field at Mistra Valley, Malta

Chris Hunt & Nicholas C. Vella

Introduction

Although historical sources for the Early Modern development of the Maltese landscape are abundant and well-documented, these records are uncorroborated by other forms of evidence. As part of investigations of the development of a field system at Mistra Valley, Malta, a sample was taken from a waterlain layer at the base of a field-fill on the edge of the valley-floor in Mistra Valley.¹ Pollen and other analyses were done on this layer to identify the environment and agriculture of an early stage in the field system.

The Mistra Valley Field System

The Mistra Valley forms part of the Mizieħ basin defined by two Coralline Limestone uplands, the Mellieħa Ridge to the north and the Bajda Ridge to the south. This basin consists of an elongated plain which narrows to the east to give way to a shallow valley – Il-Wied tal-Kalkara – at the head of Mistra Bay. The history of the landscape of Mizieħ is well documented, particularly because several land boundary disputes concerning access to common grazing grounds in the Late Medieval period took place here.² In the Early Modern period, moreover, substantial efforts were made by the Mdina *Università* and by the Order of St John's *Fondazione Lascaris* to purchase and develop lands in northern Malta.³

The lands of Mizieħ ir-Riħ consist of two parts. The basin floor together with the southern slopes of the Mellieħa Ridge with two freshwater springs at the foot of a scarp edge was the property of the Mdina Cathedral

since 1523.⁴ The territory of Mizieħ ir-Riħ also included contiguous areas to the south, in particular three caves on the southern slope of the Bajda Ridge where farmers lived and stored fodder and thorns for fuel.⁵ By the 1620s, possibly before, most of the territory had been enclosed by a rubble wall as illustrated in an enclosure map dated tentatively to this time (fig. 2 b).⁶ Details of the lease compiled by the Cathedral in 1791⁷ and the *cabreo* compiled in 1838 define the *territorio* into several parts of mediocre and bad arable.⁸ In the 1838 document the enclosures are listed thus, from east to west: *Ta Hofret migdum, Il Baida ta Hofret Migdum, il Catgha tal Hain ta Nofs, il Catgha tal Ghain Znuber, il Ghalcha ta Schiatba*. In 1677 arable land in a nearby area called *ta Sciana* was bought by the Cathedral and added to the Mizieħ estate (fig. 2 c).⁹

Contiguous lands to the south of the valley basin, consisting of the gentle, northern slopes of the Bajda Ridge and the limestone plateau itself, stretching from the Xagħra il-Hamra in the west to Ix-Xagħra tal-Għansar in the east were granted by Grand Master De Paule to the *Università* after a request had been made by its jurats in 1627.¹⁰ In 1654 the lands were in turn bought from the *Università* by the *Fondazione Lascaris* (set up by the Order of St John in 1646).¹¹ By 1658 the area which had hitherto been used for rough grazing was surrounded by walls and divided into enclosures.¹² It was surveyed by the *Fondazione* for its *cabreo* compiled in 1784.¹³ From west to east the enclosures are: *Territorio in contrada di Hain Toffieħa, appellato il Cortino di Hain*

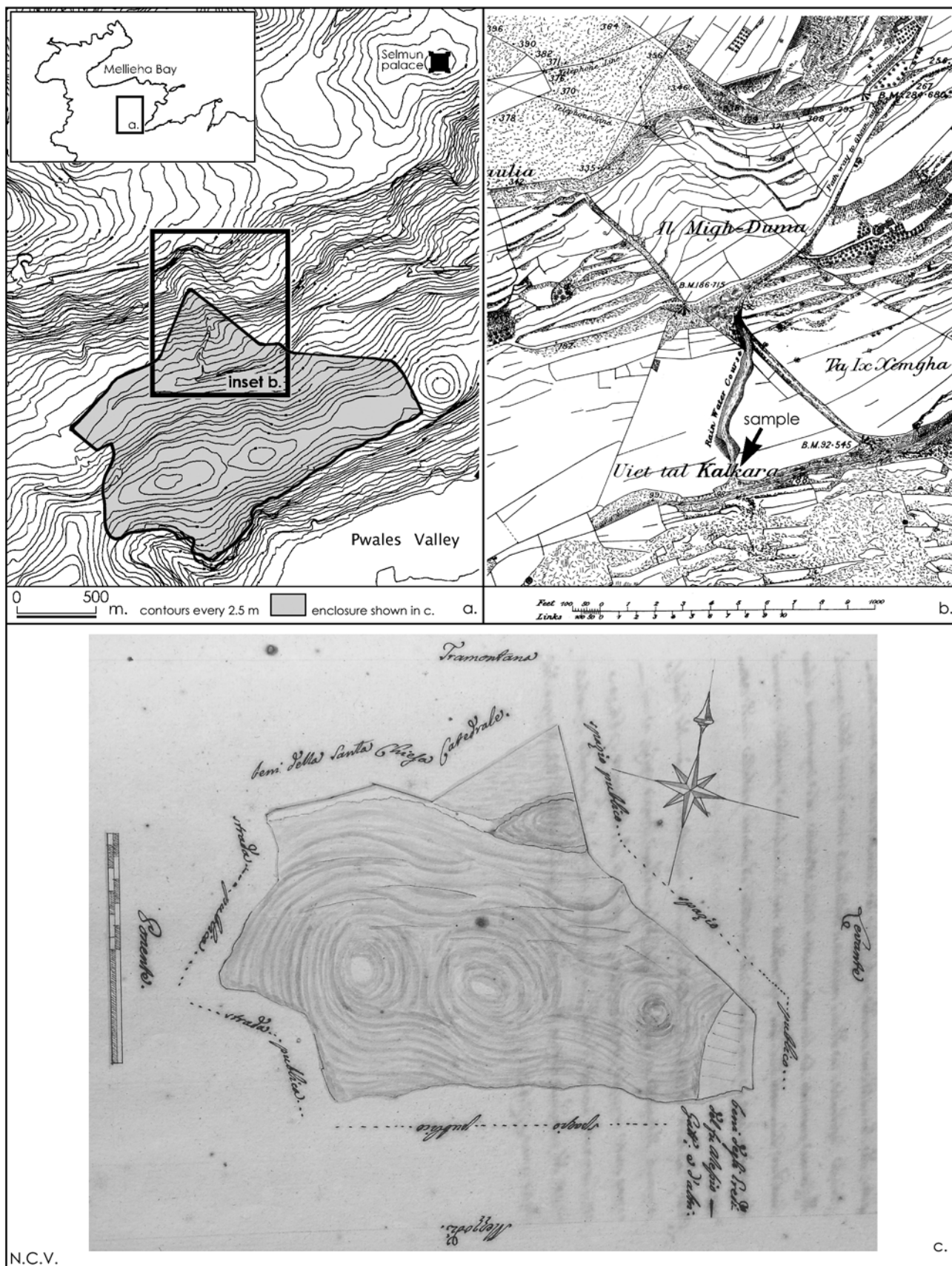


Fig. 1. (a) contour map of area discussed in the text with inset showing extent of the area depicted in (b) and extent of the enclosure shown in (c); (b) part of survey sheet 18 of the Survey of Malta published by the Ordnance Survey in 1903 and corrected in April, 1903; (c) Enclosure known as Clausura di terra posta in contrada tal Pwales, appellate Schiaret al Hansar from NLM, Treas. B 302, f. 59 (reproduced courtesy of the National Library of Malta).

Toffieha;¹⁴ *Clausura di terra in contrada Miziep Irrih, appellata Dar il Baida*¹⁵ and an additional area of the same enclosure shown on a different map;¹⁶ *Clausura di terra posta in contrada tal Pwales, appellata Sciharet al Hansar* (Fig. 1 c).¹⁷

It is possible to discern the extent of all the enclosures and territorial holdings in this area in the six inch to the mile map issued by the Ordnance survey in the late nineteenth century, last updated in 1940 (Fig. 2 c). Fig. 2 d is a plot of these enclosures, lines which demarcate land whose physical expression in the landscape is invariably the rubble wall. The curved walls which follow the contours on the sides of the ridges visible on some of the enclosure maps (e.g. Fig. 1 c) have not been included on Fig. 2 d but are evidence of a field pattern dictated largely by topography. Superimposed on these is a rectilinear arrangement of tracks and walls on the Bajda Ridge plateau, down its northern slopes and coming up against the walls that demarcate the Cathedral lands in the valley floor. These rectilinear enclosures date to the second half of the nineteenth century and are evidence for the attempt of the British Colonial government, instigated by the local *Società Economico Agraria*, to develop the region by granting rectilinear parcels of land in emphyteusis to farmers.¹⁸ The intensive form of landuse on the Bajda Ridge, on the other hand, is a recent attempt at afforestation, the latest palimpsest in this historic landscape.¹⁹ The sketch in figure 4b provides chronological tags to some landscape features mentioned here.

Stratigraphy

At GR 435788, in the sides of a drainage channel in a field above the Wied tal-Kalkara (fig. 1 a; position marked on fig. 1 b), the stratigraphy shown in Table 1 is exposed. Layer 3 is a typical Maltese field deposit and layer 1 probably has the same origin. The colour and texture of layer 2 suggests a waterlain origin.

Table 1:

Stratigraphy of the field deposits at Mistra Valley

Layer no.	Thickness (m)	Description
3	0.8-1.0	Strong-brown to reddish-brown very stony clay field soil with shells of <i>Pomatias sulcatus</i>
2	0.1-0.2	Mid grey-brown, silty clay with very occasional small stones and shells of <i>Helix aspersa</i>
1	0.2 (base unseen)	Strong-brown very stony clay

Methods

A sample from Layer 2 was subjected to the palynological preparation methods described in Hunt (1985)²⁰ - boiling in 5% potassium hydroxide solution to disaggregate, sieving on 6 micron nylon mesh to remove solutes and fines, swirling on a clock-glass to remove silt. The resulting organic concentrate was stained with safranin and mounted in glycerol for microscopic examination. All pollen and spores in the sample were counted and percentages calculated. In addition, a count of the palynofacies – the whole variety of particulate organic matter in the sample – was made using the conventions of Hunt & Coles (1988).²¹ The results are shown in tables 2 and 3. A subsample was also analysed by X-Ray Fluorescence at Huddersfield University, by Mrs M. Scott. The XRF analysis is shown in tables 4 and 5.

Palynology

The sample (Table 2) contained abundant, well-preserved organic matter, but less than 1% of this is pollen. The palynofacies assemblage is characterised by abundant plant cell walls and cuticle, mostly degraded, but mostly showing characteristic Poaceae morphology. Most of the thermally mature (charred) material is also derived from Poaceae. This is likely to reflect cereal cultivation and stubble burning in adjoining fields. Amorphous organic matter (AOM) is present in quantity, as is typical of well-manured soils and other localities with a strong flux of organic matter and high microbial activity. Other major components of the palynofacies assemblage are fungal in origin – fungal hyphae, fungal spores, vesicular arbuscular miccorhyzae (VAM). These reflect

the soil microflora and are likely to be present in this waterlain layer as the result of soil erosion.

Table 2:

Palynofacies analysis of layer 2 from the Mistra Valley

Palynofacies type	No.	%
Pollen	1	0.8
Plant cell walls & cuticle	3	2.5
Degraded plant cell walls & cuticle	24	19.7
Root caps	2	1.6
Amorphous organic matter	33	27.0
Thermally mature	12	9.8
Fungal hyphae	35	28.7
Fungal spores	5	4.1
Vesicular arbuscular miccorhyzae	3	2.5
Arthropod cuticle	1	0.8
Amoeboid cysts	1	0.8
Resinite	1	0.8
Inertinite	1	0.8
Total	122	100.0

The pollen assemblage (Table 3) is characterised by abundant *Pinus* (pine), with some Lactuceae (dandelion group) and Cereal. Apart from *Pinus*, trees are very rare, represented only by *Olea* (olive), *Eucalyptus* and *Acacia*. The last two are introduced species, probably not before the 19th century AD.²² Cultivated crop plants include undifferentiated Cereal pollen (most likely barley and/or wheat), *Zea* (Maize), *Gossypium* (Cotton) and possibly Brassicaceae (Cabbage family including Cabbage, Cauliflower, Broccoli, Turnip, Swede and Oil-Seed Rape, although this could also be pollen of a wild species). Cotton is self-fertile and the pollen grains are normally retained within the cotton boll, so would only reach the environment in unusual circumstances, such as the trampling of a boll into the ground during harvesting. The find of one pollen grain is therefore highly suggestive of cotton cultivation, known to have taken place in the fields at Mizieb ir-Riħ (at *Il Baida ta Hofret Migdum* – fig. 2 d) at least until 1791.²³ Two other components are present in the sample. Most other pollen would be derived from the Maltese native vegetation mosaic of maquis (*Cistus*, *Rhus*), garrigue (Ericaceae, *Euphorbia*), and steppe (Poaceae, Chenopodiaceae, *Artemisia*, *Plantago*, *Rumex*, *Silene*-type, *Bidens* type, *Aster* type, Lactuceae, *Serratula* type, *Bellis* type, *Convolvulus*,

Glaucium type, Caryophyllaceae, Brassicaceae, *Euphorbia*, *Centaurea nigra* type, *Agrimonia*, *Alchemilla* type, Liliaceae), although some would have invaded the fields and be regarded as agricultural weeds, notably Lactuceae, Poaceae, Chenopodiaceae, Caryophyllaceae, *Rumex*, *Serratula*, *Convolvulus*, *Glaucium* and *Centaurea*. *Montia* and the algal microfossils *Spirogyra*, *Saeptodinium* and the Chrysostomataceae would have been derived from shallow, sun-warmed standing water and most probably reflect the local depositional environment of the grey clay layer in a pool within the field system. *Borago officinalis* and *Ranunculus* are often typical of waterside habitats. The presence of the non-native species *Zea*, *Acacia* and *Eucalyptus* suggests a relatively recent date for the layer, either late in the 19th century or early in the 20th century.

Table 3:

Pollen analysis of layer 2 from the Mistra Valley

Taxon	No.	%
<i>Pinus</i>	87	55.1
<i>Olea</i>	3	1.9
<i>Acacia</i>	3	1.9
<i>Eucalyptus</i>	1	0.6
<i>Cistus</i>	5	3.2
<i>Rhus</i>	1	0.6
Ericaceae	2	1.3
<i>Ephedra</i>	2	1.3
Rosaceae	1	0.6
Cerealia	10	6.3
<i>Zea</i>	1	0.6
<i>Gossypium</i>	1	0.6
Poaceae	4	2.5
Chenopodiaceae	4	2.5
<i>Artemisia</i>	4	2.5
<i>Plantago</i>	3	1.9
<i>Rumex</i>	3	1.9
<i>Silene</i> type	2	1.3
<i>Viola tricolor</i> type	2	1.3
<i>Bidens</i> type	7	4.4
<i>Aster</i> type	2	1.3
Lactuceae	34	21.5
<i>Serratula</i> type	4	2.5
<i>Bellis</i> type	1	0.6
<i>Borago officinalis</i>	1	0.6
<i>Ranunculus</i>	1	0.6
<i>Convolvulus</i>	1	0.6
<i>Glaucium</i> type	2	1.3
Caryophyllaceae	3	1.9
Brassicaceae	4	2.5
<i>Euphorbia</i>	1	0.6
<i>Centaurea nigra</i> type	1	0.6
<i>Agrimonia</i>	1	0.6
<i>Alchemilla</i> type	1	0.6
Liliaceae	2	1.3
<i>Montia fontana</i>	2	1.3
Pteropsida	1	0.6

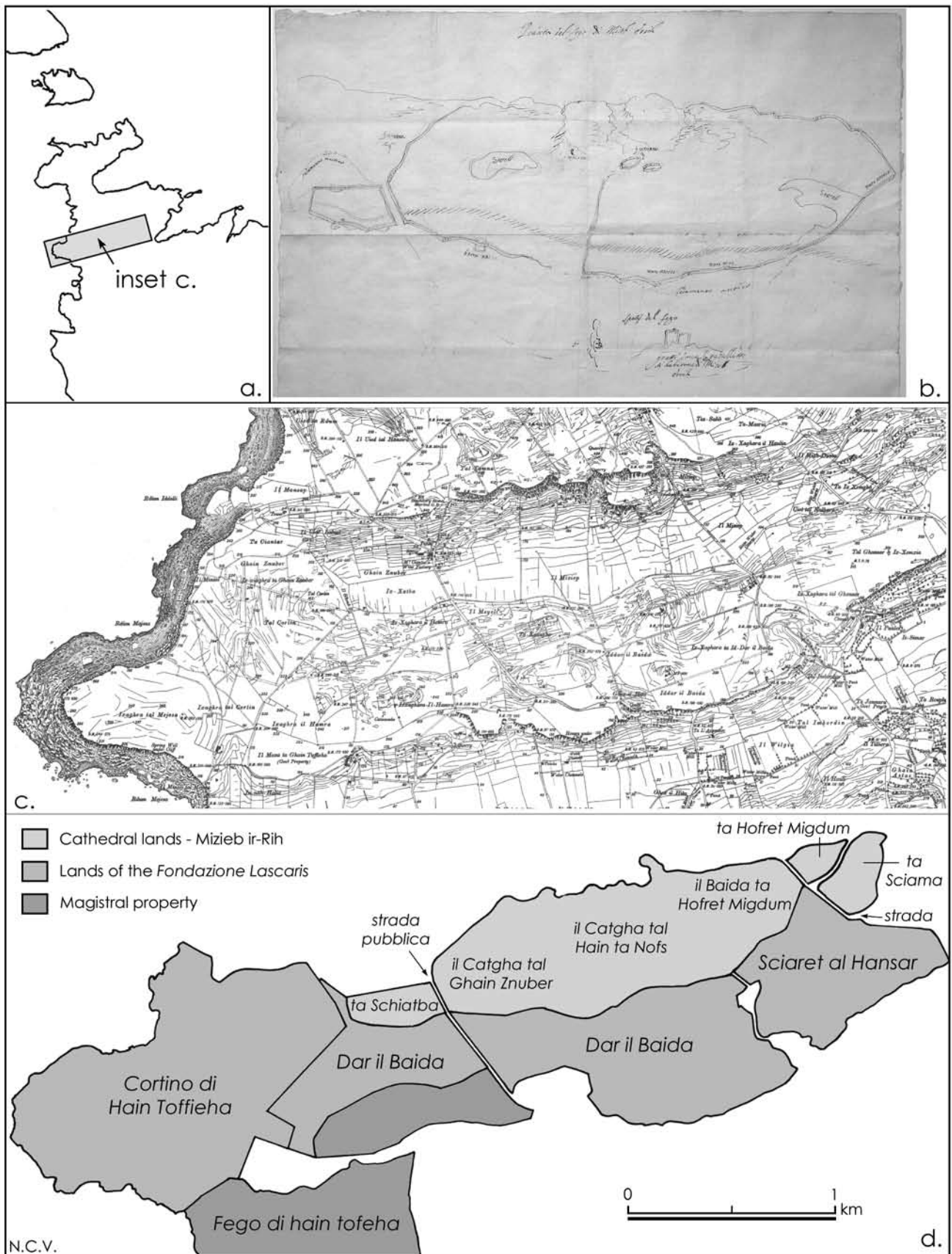


Fig. 2. (a) location map showing extent of territory included in (c); (b) enclosure map – Pianta del feogo di Mizieb Errich from ACM, Beni della Cattedrale, vol. 4, f. 6 (reproduced courtesy of the Mdina Cathedral Chapter); (c) part of sheet 3 in the six inch to the mile series produced by the Ordnance Survey in 1940; (d) enclosure map of various land holdings produced relative to the scale of map in (c).

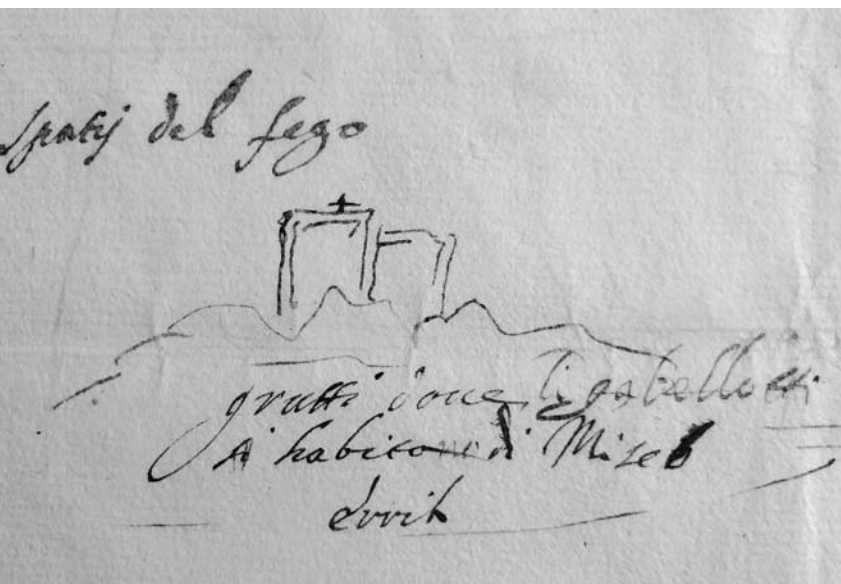


Fig. 3. Detail of the Pianta del fego di Mizeb Errich shown in fig. 2, a.

Indeterminate	4	2.5
Total	212	100.0
<i>Spirogyra</i>	2	1.3
Chrysosomataceae	1	0.6
<i>Saeptodinium</i> sp.	1	0.6

Geochemistry

Geochemical analyses were made of layer 2 from the wall-fill, plus samples of the Blue Clay and Upper Coralline Limestone bedrocks which outcrop upslope from the sample site and a sample of calcreted (cemented with calcium carbonate through pedogenic processes) Quaternary slope deposits which also outcrops at Mistra. The samples were analysed using X-Ray Fluorescence on powdered sample in a Spectro X-Lab. Results for selected elements are shown in tables 4 and 5 as parts per million. In table 4, the major elements of the sample are shown. This shows that layer 2 is derived from a mixture of Blue Clay and Coralline

Limestone.

In Table 5, selected heavy metals are shown. The sample from layer 2 is enhanced in copper (Cu), zinc (Zn) and lead (Pb) relative to the values in the bedrock samples. This is likely to be at least partially the result of atmospheric fallout during the accumulation of layer 2, and confirms a late 19th or early 20th century age for the layer, since heavy metal fallout was enhanced in the Maltese Islands during the last 150 years as a result of industrial development.²⁴

Conclusion

The waterlain deposit within the field fill thus provides useful information about Maltese agriculture during the early years of the field system. There are lines of evidence both from the pollen, with the presence of the introduced species, and from the heavy metal content, that the deposit dates to the later part of the nineteenth or the early years of the twentieth century AD. The decline of cotton production in the course of the 19th century²⁵ suggests that the layer is not younger than this.²⁶ The natural environment locally was probably very little different from the modern. There is evidence for cultivation of a number of crops, including Olive, Barley or Wheat, Maize, Cotton, and perhaps a Brassica.

Cartographic and other documentary evidence also confirms this picture. By 1903 when survey sheet 18 was published by the Ordnance Survey at a scale of 1:2500, the field where the pollen sample was taken is clearly in place, with the soil kept back by a rubble retaining wall skirting the Wied tal-Kalkara

Table 4: Major elements in samples from Mistra Valley (ppm)

Sample	Mg	Al	Si	P	S	K	Ca
Blue Clay	5130	53520	139200	569	435.1	16880	78600
Upper Coralline Limestone	450	3805	10280	62	613.6	890	374300
Calcrete		2695	4354	63	392.7		398300
Field Fill layer 2	870	18020	50180	343	802.9	5994	262600

Table 5: Heavy metals in samples from the Mistra Valley (ppm)

Sample	Cr	Co	Ni	Cu	Zn	Cd	Hg	Pb
Blue Clay	157.9	49.9	36.2	20.6	88.4	5.2	4.9	24.9
Upper Coralline Limestone	93.5	47.3	9.1	7.3	16.8	7.8	9	10.8
Calcrete	84.1	30.7	8	4	12.1	9.2	7.3	6.6
Field Fill layer 2	142.7	48.5	21.4	35.5	121.6	6	5.1	198.6

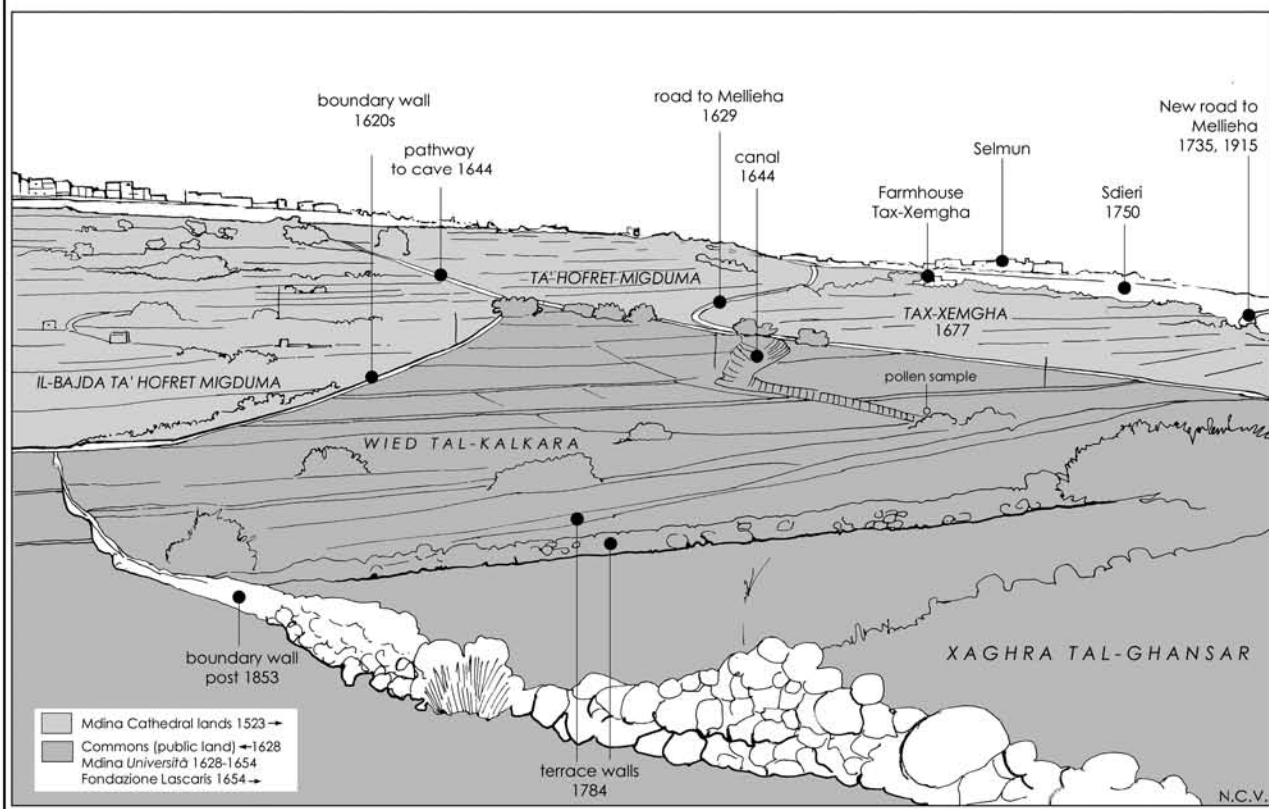


Fig. 4. Sketch (bottom) of landscape features shown in the photograph (top) for which it was possible to provide a chronological tag on the basis of documentary and cartographic evidence. Point of observation GR4343, 7855

(Fig. 1 b). This field was given on a 99-year lease to farmers from Naxxar in 1862. The contract dated 17 March 1863 stipulated that the farmers had four years to break the surface of the rock wherever possible, and cover with soil to a sufficient depth the area in order to turn it into arable land.²⁷ In 1644, this same area then belonging to the *Università*, where runoff water had formed a canal (extant to this day), was to be left 'free and uncultivated' by those being asked to rebuild collapsed rubble boundary walls marking the adjoining Cathedral lands.²⁸ In 1784, when the *Fondazione Lascaris* had this same area surveyed, the field does not seem to have existed (fig. 1 c).²⁹ The area to the east of the rainwater canal was rendered in watercolour and ink in a way that is reserved for rocky surfaces rather than arable.³⁰

Although this study is limited chronologically, it suggests that similar studies elsewhere in the Maltese Islands may prove worthwhile and may throw new light on the evolution of an ancient landscape.

Acknowledgements

Part of the research presented here was conducted whilst one of us (NCV) was on sabbatical leave from the University of Malta in the spring of 2006. Documentary research was much facilitated by the kindness of the archivists and officers in charge, in particular Maroma Camilleri (National Library), Nicholas Aquilina and Joe Mifsud (Chief Draughtsman's Office), Mario Gauci (Mdina Cathedral Archives), and Raymond Bonnici (Archiepiscopal Archives). Fruitful discussions have been had with Dr Anton Bugeja and Mevrick Spiteri who have been instrumental in pointing out source material related to land tenure in areas contiguous to the ones discussed here. Finally, we are grateful to Charles Dalli and Prof. Stanley Fiorini, both of the University of Malta, who helped us understand the content of various documents used here.

Abbreviations

AAM = Archiepiscopal Archives, Malta
 ACM = Archives of the Cathedral of Mdina, Malta
 CD = Chief Draughtsman's Office, Malta
 NAM = National Archives, Malta
 NAV = Notarial Archives, Valletta, Malta
 NLM = National Library, Malta

Manuscript sources

Library manuscripts

Lib. 1302 = Raccolte delle rendite di Malta, Gozze, e Roma di netto compensare le spese per le concie necessarie, che tiene la fondazione Lascaris annosate nel Cabreo ultimamente fatto in conformità delle decreti di sua Em.a. 1658.

Treas. B 302 = Cabreo de' Beni Urbani e Rustici posti nell'Isola di Malta, spettanti alla Fondazione dell'Emo Signor Gran Mro della S.R.G. Frà Gio-Paolo Lascaris Castellar. 1784.

Cathedral Archives

Beni della Cattedrale, vol. 1, 1528-1609
 Beni della Cattedrale, vol. 3, 1786-1801
 Beni della Cattedrale, vol. 4, 1523-1682
 Beni della Cattedrale, 1590-1833

Archiepiscopal Archives

Cabreo 1838 = Descrizione Generale di tutt'i Beni Stabili esistenti nella isola di Malta e Gozo spettanti alla S. Chiesa Cattedrale Archivescovile di Malta, colle lore denominazioni, piante, capacità, contrade, confini, concessioni ed annuo canone; e di alcuni Ricognizioni, terminata correndo l'anno 1838.

Notes

1. This investigation was carried out to provide data in connection with the Xemxija Archaeological Survey carried out by the Department of Classics and Archaeology of the University of Malta in 2001-2002 as part of undergraduate training in surveying and fieldwalking techniques. The report of the excavation of a Punic tomb carried out during the survey was published in N. C. Vella, A. Borg, B. Borg, N. J. Cardona, K. Chetcuti-Bonavita, A. Corrado, E. DeGaetano, K. Fenech, C. Sagona, J. Samut-Tagliaferro, I. Vella Gregory, 'Report on the excavation of a Punic tomb, Bajda Ridge, Xemxija (Malta)', *Malta Archaeological Review*, vol. 5, (2001), 16-22, whereas the results of the field survey are being prepared for publication by one of us (NCV). The survey departs from the resolve that archaeologists stand to benefit from a study of landscape that affords attention to the present and recent past as much as it does to more remote and ancient pasts. In this way, the supposed great antiquity of certain landscape features and production methods can be questioned against the mutability of rural Maltese economic and settlement strategies. For Malta, see comments in N. C. Vella, 'Phoenician and Punic Malta', *Journal of Roman Archaeology*, vol. 18, (2005), 445, and, more generally, S. B. Sutton, 'Introduction: Past and Present in Rural Greece', in S. B. Sutton, (ed.), *Contingent Countryside: Settlement, Economy, and Land Use in the Southern Argolid since 1700*, (Stanford, California. Stanford University Press, 2000), 1-24.
2. G. Wettinger, 'Agriculture in Malta in the Late Middle Ages', *Proceedings of History Week*, (1981), 31-34; and id., 'L-inħawi tal-Mellieħa fiż-Żmien Nofsani', in J. Catania, (ed.), *Il-Mellieħa mal-milja taż-żmien*, (Mellieħa. Kunsill Lokali Mellieħa, 2002), 40-47.
3. B. Blouet, *The Changing Landscape of Malta During the Rule of the Order of St. John of Jerusalem, 1530-1798*, (Unpublished PhD thesis, University of Hull, UK, 1963); see also S. Fiorini, 'The municipal councils in the Maltese Islands: 1530-1800', in J. Manduca, (ed.), *The Making and Unmaking of the Maltese Universitas, A Supplement to Heritage*, (Malta. Klabb Kotba Maltin, 1993), 16,20.
4. ACM, Beni della Cattedrale, vol. 1, 1528-1609, f. 1; Beni della Cattedrale, 1590-1833, f. 62r.
5. Beni della Cattedrale, 1590-1833, f. 62r.
6. ACM, Beni della Cattedrale, vol. 4, 1523-1682, f. 6. According to Wettinger the map is 'probably early 16th century', (G. Wettinger, *Place-Names of the Maltese Islands ca. 1300-1800*, [Malta. Publishers Enterprises Group Ltd, 2000]), 394. In another contribution, Wettinger (2002), in a sheet of errata-corrige placed as an insert to the publication, provides a caption to the map, giving the date as 'probably 1569'. The large folded map originally formed part of the Beni della

- Cattedrale vol. 4, 1523-1682, where it was bound with the 1569 act of the sale of the land at Mizzieb ir-Riħ (folios 5 and 7). A few years ago the map (folio 6), was removed for restoration and placed in the Drawings Archives, file no. 67, inv. no. 819. A photocopy of the original is now found in its place. It is more likely, however, that the map dates to the late 1620s when a dispute concerning some caves may have resulted in its production by Church surveyors. In 1627 a request was made to the Grand Master De Paule by the jurats of the Mdina *Università* to enclose 'terreni spatij publici' in this area with 'muri di pietra secca', including caves overlooking the Pwales valley, in particular 'Ghar Schalli' (NLM, Lib. 670, f. 58). The grant came on 21 January 1628 according to G.F.Abela, *Della Descrittione di Malta*, (Malta, 1647), 74-75; also NLM, Lib. 670, f. 60. In the same year, the Mdina Cathedral considered these same caves part of its lands at Mizzieb ir-Riħ (ACM, Beni della Cattedrale 1590-1833, f. 62v.), as specified on the map itself where the caves are shown in an area denoted 'spatij del fegeo' and defined as 'grotte dove li gabellotti habitono di Misedb erriħ' (figs. 2 b and 3).
7. ACM, Beni della Cattedrale, vol. 3, 1786-1801, ff. 164-234.
 8. AAM, Cabreo 1838.
 9. ACM, Beni della Cattedrale, 1590-1833, f. 62v.
 10. NLM, Lib. 670, ff. 57-59.
 11. NLM, Lib. 1302, ff. 21v.-22v.; NAV, S. Attard R.31, ff. 827-832v.; 23 May 1654; Blouet, 106.
 12. Blouet, 107.
 13. NLM, Treas. B 301.
 14. *Ibid.*, f. 71.
 15. *Ibid.*, f. 75.
 16. *Ibid.*, f. 77.
 17. NLM, Treas. B 302, f. 59.
 18. H. Bowen-Jones, J. C. Dewdney, and W. B. Fisher, *Malta: Background for Development*, (Durham. Department of Geography, Durham Colleges, 1961), 303. Reference to the debate on the land to be reclaimed for agricultural purposes can be found in the *Gazzetta Agraria Maltese* anno 1, no. 7 (18 ottobre 1855), 152-153. The lands visited by the commission set up to identify areas for reclamation are listed in the *Gazzetta Agraria Maltese* anno 2, no. 10 (1 marzo 1856), 262. The report of the Commission was written by V. Azopardi, *Rapporto della Commissione sulla utilità di concedere in enfiteusi le terre incolte del Gruppo di Malta*, (Malta. Società Economico Agraria, 1848). The lands known as Ix-Xagħra tal-Għansar are included in tenement 197, consisting of 445 tumoli of Crown property lands of good and bad quality in Pwales and Simar given out as allotments on 2 August 1854 (NAM, PW 175, 1854, no. 74). They are seen on survey sheet 18 of the roll containing the *Government Property Survey Sheets 1-70* at the Chief Draughtsman's Office, Ministry for Resources and Rural Affairs, Floriana.
 19. H. G. Keith, *Report of the Government of Malta on the Afforestation of Waste Lands and the Development of Tree Planting on Agriculture Lands in the Maltese Islands*. (Malta. Central Office of Information, 1956), 9; extent shown on CD roll 50M/drawing 2088.
 20. C. O. Hunt, 'Recent advances in pollen extraction techniques: a brief review', in N. R. J. Fieller, D. D. Gilbertson & N. G. A. Ralph (eds.), *Palaeobiological investigations: research design, methods and data analysis*, BAR International Series 266, (Oxford. Archaeopress, 1985), 181-188.
 21. C. O. Hunt and G. M. Coles, 'The application of palynofacies analysis to geoarchaeology', in E. A. Slater and J. O. Tate, (eds.) *Science and Archaeology*, BAR British Series 196, (Oxford. Archaeopress, 1988), 473-484.
 22. The introduction of new species to Malta is not easy to determine. It is known that specimens of *Eucalyptus* were collected in Australia and taken to Europe at the end of the eighteenth century, (R. W. Doughty, *The Eucalyptus: A Natural and Commercial History of the Gum Tree*, (Maryland. Johns Hopkins University Press, 2000). References to *Eucalyptus* in nineteenth-century thesauri of Maltese flora (e.g. S. Zerafa, *Flora Melitensis Thesaurus*, [Malta. 1831], and C. Grech Delicata, *Flora Melitensis*, [Malta. 1853]), do not occur but *Eucalyptus Globulus* is listed in the *Rendiconto della Esposizione Agraria* for 1875 (p. 55). On the other hand, *Acacia farnesiana* and *Zea* are listed by Zerafa, (pp. 41, 78) ; *Zea* is also mentioned by Giacinto, *Saggio di agricoltura per le isole di Malta e Gozo*, (Messina. Giovanni del Nobile, 1811), 115.
 23. ACM, Beni della Cattedrale, vol. 3, 1786-1801, f. 195v.
 24. F. Carroll, *The potential use of harbour sediment in the construction of past environmental history*, (Unpublished BSc dissertation, University of Huddersfield, UK, 2001).
 25. Giacinto (1811), 219; see also G. P. Badger, *Description of Malta and Gozo*, (Malta. M. Weiss, 1838), 53.
 26. By the time that Giacinto made a reasoned plea to support cotton cultivation in Malta, cotton from Egypt and America was flooding the local market (C. Giacinto, *Mezzo stabile di prosperità per le isole di Malta e Gozo*, [Malta, 1825]). In 1855, cotton samples from Dingli and Qrendi were deemed of too low a quality to compete with foreign imports and to merit a prize in the agricultural fair held that year (*Gazzetta Agraria Maltese*, [1855], 186). Experimentation in cotton cultivation in Malta, however, persisted for several decades (*Atti della Società Economica Agraria* [1907], 11). Seventeenth century cotton cultivation in Malta is discussed at length in J. Debono, 'The Chamber of Commerce and the cotton trade of Malta in the eighteenth century', *Melita Historica*, vol. 10, (1988), 27-50; on Egyptian cotton, see R. Owen, 'A long look at nearly two centuries of Long Staple cotton', in A. K. Bowman and E. Rogan, (eds.) *Agriculture in Egypt from Pharaonic to Modern times*, Proceedings of the British Academy 96, (Oxford. The British Academy, 1999), 347-365.
 27. NAM, LG 2613/38; CD, roll 50H/drawing 650.
 28. ACM, Beni della Cattedrale, vol. 4, 1523-1682, f. 274v.
 29. NLM, Treas. B 301, f. 59.
 30. A close study of the maps of fields included in the *cabreo* of the *Fondazione Lascaris*, NLM, Treas. B 301, shows that besides the use of colour banding to indicate field boundary ownership, the compiler used different colours and rendering to convey information about land quality. Arable land of very good or good quality (*buonissima, buona qualità*) was rendered in pink hatching sometimes interspersed with grey ones (e.g. f. 49); arable land of mediocre quality (*mediocre qualità*) was rendered in grey and pink shades (f. 61); bad quality land (*malissima qualità*) was represented in shades of grey and black clearly meant to represent a rock surface or outcrop (f. 73).