A Treasure Lost: The Portocarrero collection of scientific instruments and interest in the sciences in Hospitaller Malta

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Abstract: *One of the little-known treasures acquired by the Order of St John during the eighteenth century and brought over to Malta consisted of a collection of scientific and mathematical instruments. This impressive collection, which was added to during the succeeding years, eventually vanished without a trace. Further evidence of scientific pursuits in areas such as aerostatics, astronomy, climatic observations and natural history confirm a growing local interest in the various sciences, itself reflecting contemporary developments in Europe.*

Keywords: *Scientific and mathematical instruments, aerostatics, astronomy, climate, natural history, Malta.*

The objective of this paper is to highlight an aspect of cultural life in Malta during the rule of the Order of St John which has as yet received sporadic attention, namely the upsurge of interest in scientific pursuits, particularly during the second half of the eighteenth century and mostly resulting from the Enlightenment's fascination with the pure and applied sciences. Members of the Order, hailing from among the noblest – and wealthiest – echelons of Europe familiarized themselves with new scientific discoveries and their interest was, in turn, reflected through the development of collections on the island as well as through their involvement in a number of scientific endeavours which have gone mostly forgotten. As in the case of the various artistic fields, whether painting, sculpture, architecture and the minor arts, the presence of the Order in Malta provided the right contact with mainland Western Europe for contemporary scientific activity to be in some way reflected on the island.

The Portocarrero collection

Joaquin de Portocarrero (1681–1760), Marquis of Almenara and member of the illustrious Iberian family bearing that name, was a member of the Order who, following a successful diplomatic career in the service of various states and of the

papacy, was created Cardinal by Benedict XIV in 1743. From the local perspective Portocarrero is deservedly considered as a co-founder of the Order's eighteenth-century *Biblioteca Pubblica*, one of the foremost cultural institutions set up during the Order's rule and which was later to develop into the National Library of Malta. Portocarrero named the Order as universal heir to his very considerable wealth. His impressive library, consisting of some five thousand volumes, was, upon his demise, spared being sold and dispersed as was the standard procedure in such circumstances and was bought *in toto* from the Order's Common Treasury by the Balí de Tencin. The latter's intention was to unite it with his own sizeable collection and create a public library on the island worthy of the name.[1] The Portocarrero collection was subsequently inventoried and dispatched to Malta from Rome. The collection's inventory has survived and this incidentally provides the possibility of ascertaining the extent to which Portocarrero's library is still extant within the present National Library of Malta collection – no mean feat to undertake but certainly one with considerable academic interest. The same applies to the de Tencin bequest, the original inventory of which is similarly still available.[2]

Besides printed books and manuscripts, the purchase made by de Tencin also comprised Portocarrero's collection of mathematical and scientific instruments. The cardinal was actively interested in science and such interest was indeed reflected in the considerable number of books and manuscripts on various scientific subjects that he possessed. Thus among his books were editions of Nicolas Bion's publications on scientific and mathematical instruments.[3] Portocarrero's instrument collection was similarly inventoried and shipped over to Malta. Table I below describes the contents of the collection as given in the contemporary inventory:

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[1] For a biography of Portocarrero see R.L. Dauber, *Bailiff Frá Joaquin de Portocarrero (1681–1760): Co-Founder of the Library of Malta*, Malta 2003; for that of de Tencin, E.R. Leopardi, 'Fra Jean Louis Guerin de Tencin, Founder of the first Public Library in Malta', in *Revue de l'Ordre Soverain de Malte* (April–June 1958), pp. 79–84.

[2] N[ational]L[ibrary of] M[alta] Lib.[ary] Ms.[Manuscript] 264 and 265 consisting of the Portocarrero and de Tencin library inventories respectively. For a recent study of the *Biblioteca Pubblica*'s early years see W. Zammit, *The Dissemination of Unorthodoxy and New Ideas in Malta, 1700–1798*, unpublished Ph.D thesis, Department of History, University of Malta, 2001, 177–89.

[3] These editions comprised *Traité de la construction et des principaux usages des instruments de mathematique*, 1709 edition, and *L'usage des globes celeste et terrestre*, Paris, 1728 edition. According to the National Library of Malta catalogue, the copies to be found in the present collection are two editions of the *Traité* in French and English (The Hague 1723 and London 1758 respectively) and one of *L'usage* (Paris 1751).

Table I
Inventory of mathematical instruments pertaining to the estate of Cardinal Portocarrero (1760)[4]

Nota di diversi Istromenti di Matematica

Una machina Phneumatica con tre campane, due emisferi, altro pezzo per il campanello, et altro per prouvare l'estrazzione dell'aria, e ciò molta vite.

Un stuccio di zegrino negro con diversi Istromenti Mattematici cioè: [containing the following seven items]

Un quadrante con due cannocchialini di lunghezza un palmo e mezza.

Una squadra.

Un archipendolo.

Un compasso di proporzione.

Una tavoletta con diverse misure.

Due compassi con le sue mutazioni.

Una bussola colla calamita.

Una cassetta di pelle nera con diversi istromenti mecanici d'accaio componenti il numero di pezzi 18.

Una camera optica piccolina.

Un stuccio di zegrino dentro un migroscopio d'avorio con diversi pezzi.

Un stuccio di cordovano rosso con entro una Bussola d'agrimensore d'ottone con calamita.

Una cassettina o'sia stuccio coperta di corame nero entro la medesima un livello d'ottone con due cannocchiali, e cannello con lo spirito per mettere in piano.

Altra cassettina di cordovano rosso con entro un Instromento mattematico con colonetta d'ottone inargentato in mezzo et il resto di legno.

Altra cassetta simile lunga, un Instrumento di legno per riduzione.

Un stuccio con dentro un migroscopio solare d'ottone e bussolini di legno di busso.

Una cassetta di legno bianca con dentro un cannocchiale neutonico con suo piede d'ottone.

Un compasso fedele grande di ferro.

Un compasso di proporzione con righe d'ottone di diversa misura.

Un stuccio di cordovano rosso con dentro un orologgio solare d'ottone a dieci facciate.

Altro orologgio solare di legno.

Un stuccio con entro un quadrantino per fare orologgi solari.

Altro di corame nero foderato rosso con entro un orologgio solare.

Un quadrante per fare orologgi solari d'ottone.

Un stuccio di zegrino nero con entro Istromenti matematici d'ottone.

Altro simile con Istromenti simili.

Altro stuccio ovato scantonato foderato simile con entro un p.tro. di viaggio per orologgi.

Altro orologgio solare piccolo d'ottone.

Una scatoletta di pelle negra con entro un orologgio solare a calamita d'ottone dorato, e targhetta d'argento.

Altra scatoletta di corame rosso con entro orologgio solare d'argento consistente un cerchio.

Altra cassettina nera con entro un orologgio solare d'argento.

Un stuccio di cordovano rosso con entro un orologgio solare con bussola d'avorio.

Altro stuccio di zegrino nero foderato di velluto rosso con entro un orologgio solare d'argento.

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[4] NLM Lib. Ms. 264, pp. 163–5.

Altra scatolina di pelle rossa con entro orologgio d'argento simile.
Altra scatoletta d'avorio dentro impresso orologgio solare.
Una scatoletta piccola con entro un orologgio solare.
Una scatoletta rossa con entro una bussola d'ottone.
Altra negra con entro bussola, et orologgio solare, e suoi pezzi d'ottone con porzione d'argento.
Un stuccio di pelle verde con compasso e suoi pezzi d'ottone.
Un migroscopio di pelle verde con boccagli d'avorio.
Un stucetto di pelle nera con entro un piccolo livello e cannellino con spirito d'ottone.
Altro simile verde con dentro una calamita piccola legata in argento.
Due prismi di cristallo d'Inghilterra legati con sue viere d'ottone in due stucci.
Tre righe piccole d'argento, e due penne o'sian lapis d'argento.
Un compasso et altri piccoli ordegni d'ottone.
Un cannocchiale di pelle nera e viere d'avorio longo palmi 6.
Un rame per imprimere con disegno d'orloggi solari.
Cinque tavole, et un calendario perpetuo per osservazioni matematiche mancante il calendario.
Un armillare d'ottone antica con piede di legno.
E molti altri pezzi di diverse sorti di robba per uso de mattematici.

The Portocarrero collection thus comprised an impressive variety of mathematical and scientific instruments, mostly developed during the seventeenth and eighteenth centuries. These included an array of compasses, microscopes, spirit levels, measuring instruments, Newtonian telescopes, a variety of solar clocks as well as an armillary sphere, a pneumatic machine and a small optical camera.[5] It is moreover highly likely that at least a number of items in the collection consisted of antique pieces, while others are described as being made of silver and hence likely to have been of interest from an artistic viewpoint.

The pneumatic machine or vacuum pump was possibly the largest and most impressive item in the collection. Pneumatic machines consisted of rather large and elaborate air pumps. Developed from the second half of the seventeenth century onwards, these were fitted with one or two crank-operated cylinders, a rod, or gear and rack work system and topped with a sealed glass container or bell-jar into which a ringing bell was placed. The air was removed from the glass sphere, thus demonstrating the elimination of sound in a vacuum. Small animals were sometimes placed under the pump bell-jar and their death by asphyxia demonstrated the effects of lack of air. Alternatively the glass sphere was substituted by a metal container into which air was pumped, demonstrating the effects of higher than normal air pressure. The Portocarrero pneumatic machine seems to have been rather

[5] For an interesting near-contemporary study of solar clocks by a Maltese see *Breve trattato d'horologij solari per via di tangenti*, by the priest Domenico Pace, NLM Lib. Ms. 1396. For a detailed study of clocks in Malta see G. Bonello, 'Foot-Notes for a History of Time-Keeping in Malta', in *Antique Maltese Clocks*, J. Manduca (ed.), Malta, 1992, pp. 12–33.

sophisticated since it comprised no less than three crystal glass bells, two glass domes and another container made of brass. It was again listed and described as part of the public library's collection of instruments around 1773 (Table II, below). The presence of a pneumatic machine on the island however predates the Portocarrero specimen by some years since another one is known to have been in possession of the Jesuit College (see below).

The reference to a 'small optical camera', which is again mentioned in the 1773 list, refers to a portable *camera obscura*. This consisted of a box-like sketching instrument. A lens in the drawtube and a mirror at 45 degrees to the horizontal focussed the image onto a ground glass screen on the top of the box. A piece of paper was put onto the screen and the image was copied directly.

The Portocarrero instrument collection was housed in the *Biblioteca Tanseana*, the library established by de Tencin for public use. De Tencin had acquired from the Order the lease of an edifice, known as *il Forfantone* and situated in the corner between present day Republic and St Lucia streets. The public library remained in that building until the transfer to the present National Library edifice in 1812, even though the latter had been completed by 1796. Following the death of de Tencin on 17 June 1766, the public library passed under the direct administration of the Order and a commissioner was regularly appointed to assume overall responsibility for it. Two Maltese librarians were appointed in succession, the first being the erudite Giovanni Paolo Francesco Agius de Soldanis. Following his death in 1770, de Soldanis was succeeded by Gioacchino Navarro. The latter was to hold the appointment until his death in 1813, thus serving the Order's, the French and the British administrations respectively. The Portocarrero collection, together with some other artefacts of a mainly antiquarian interest not only remained an integral part of the library collection, but it was actually augmented through the addition of instruments formerly in possession of deceased members of the Order.

In the first volume of his monumental *Malta Illustrata*, printed in Malta in 1772, Count Giovanni Antonio Ciantar provides further crucial details regarding the instrument collection and its integration within the public library. He describes the *Forfantone* premises as being made up of six rooms, one of which was larger than the rest. One of the rooms housed the collection of antiquities as well as the instrument collection. While clearly not listing every item pertaining to the latter, Ciantar describes the collection in quite some detail. He thus states that the instruments were stored in a large cupboard, a detail which might explain why the collection was overlooked in practically every subsequent account describing the library and its holdings. Ciantar describes the collection as being made up of celestial and terrestrial globes, armillary spheres, the pneumatic machine, which he describes as 'Boyle's machine', telescopes, microscopes, sundials, compasses and other items,

the most noteworthy he lists as being an annual calendar in copper, a terrestrial and celestial globe, a copper polyhedron clock and a Newtonian telescope.[6]

Another list describing the instrument collection and datable to around 1773 confirms the addition of items to the original Portocarrero collection.

Table II
Inventory of the collection of mathematical instruments at the Public Library (*c.* 1773)

Un orologio orizontale d'avorio con ago calamitate.
Una piccola bussola d'ottone.
Orologio solare a calamita, d'ottone dorato.
Orologio solare d'argento.
Orologio gnomico d'argento.
Orologio d'avolio con bussola.
Orologio piccolo con bussola.
Due Stucchi di Zegrino con stromenti Matematici.
Stucchio di pelle verde con compasso, e suoi pezzi d'ottone.
Due prismi di cristallo d'Inghilterra legati con suo viere d'ottone in due stucchj, verde.
Due orologj armillari.
Un stucchietto di Zegrino con microscopio d'avorio.
Cassetta di legno con regole d'Aritmetica.
Un pesaliquori.
Tre piccoli stucchi uno de quali contiene un piccolo livello.
Orologio solare d'accaio.
Cassettina continente una tavola in carta per trovare l'ore per recitare il divino uffizzio.
Un compasso fedele grande di ferro, etc.
Orologio astronomico di rame in anello.
Dodecadra con bussola di rame indorata.
Microscopio verde con boccagli d'avolio.
Orologio universale di rame.
Quadrante di legno.
Bussola d'Agrimensore d'ottone con piede.
Machina Pneumatica con tre campane di cristallo, due emisferi, e altro d'ottone.
Alcuni ordegni per orologiari.
Un rame per imprimere con disegno d'orologi solari.
Un quadrante con due cannochialini.
Altri varj stromenti Matematici.
Camera optica.

[6] G.A. Ciantar, *Malta Illustrata*, vol. 1, Malta, 1772, pp. 70–1, 'In una di queste [library rooms] si va formando un Museo . . . Ove pure si trova un grand'armario, in cui vi sono de'Globi celesti, e terrestri, delle sfere Armillari, la macchina Boileana, de'Telosćopi, Microscopi, e degli Orologi Solari, delle Bussole, e diversi altri stromenti di Matematica. Tralle altre cose da notarsi vi è un annulo Astronomico di rame, un globo terrestre, ed un altro celeste, ed un orologgio poliedro parimente di rame, il cannocchiale Nestoniano *(sic)*, e diversi altri stromenti.'

Cannocchiale Neutonico con suo piedistallo d'ottone.
Microscopio solare d'ottone, e bussolini di legno di busso.
Instromento Matematico a'colonna per dirigere il ragio visuale.
Un declinatorio di rame.
Instromento di legno detto pentografo per ridutione.
Linea oraria di rame.
Varj stromenti di Matematica, e sono un compasso di redutione, stromento per descrivere una courva, etc.
Livello, e cannocchiali di rame.
Un quadrante per fare orologi solari di rame.
Varj Instromenti matematici.
Orologio a'più facciate di cartone.
Disegno della luna sopra un cartone.
Stromento declinatorie di legno.
Orologio solare di legno.
Sfera armillare di rame.
Camolo inutile porzione di qualche tromba .

Spoglio del V. Balí Belmont

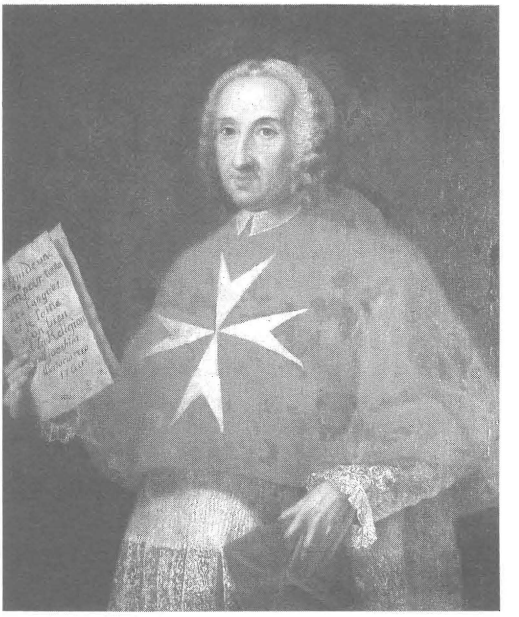
Pentografo di Rame col suo piede di legno.
Un occhiale con specchio di riflessione.
Un orologio universale d'ottone (picciolo).
Un piede di misura inglese d'avolio.
Un altro di busso.

Globi e Sfere

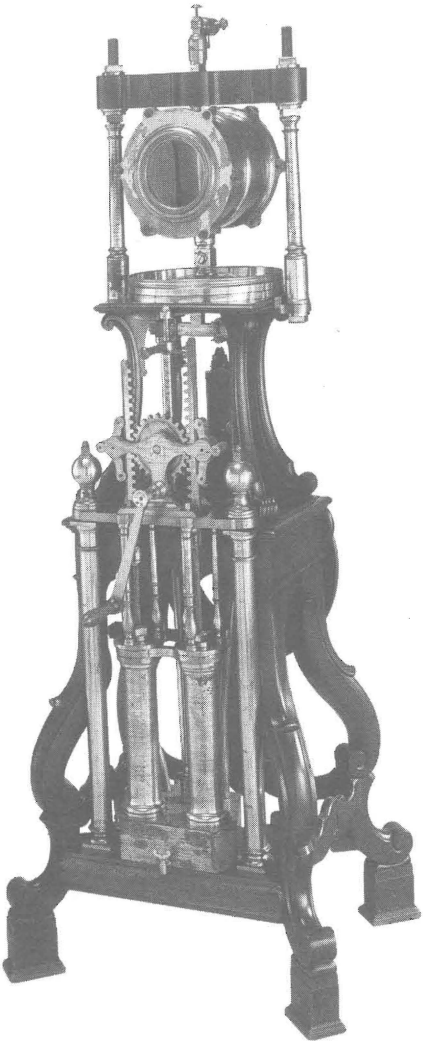
Una sfera armillare di rame. (già suprascritta)
Un altra di cartone.
Un altra minore di cartone.
Un globo celeste grande col meridiano di rame.
Un altro simile.
Un altro minore di cartone soltanto.
Un altro simile.
Un globo terrestre grande col meridiano d'ottone.
Un altro simile.
Un altro minore di cartone.
Un altro simile.

Balí Jacques Armand de Vachon Belmont, a prominent member of the Order, died on 11 November 1766, just five months following de Tencin's own demise.[7] The integration of Belmont's own collection of scientific instruments, as indicated in Table II above, thus confirms that the collection continued to be developed when the Order took over de Tencin's library. Among the notable additions to the original Portocarrero collection were a number of terrestrial and celestial globes.

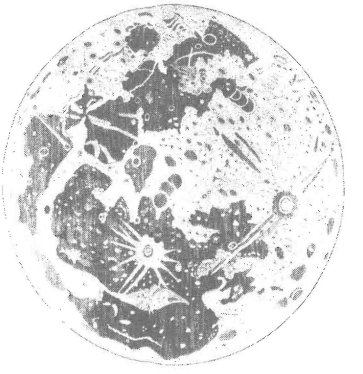
[7] On Belmont see N. de Piro, *The Sedan Chair in Malta: Is-Suġġetta*, Malta, 1993, p. 53.



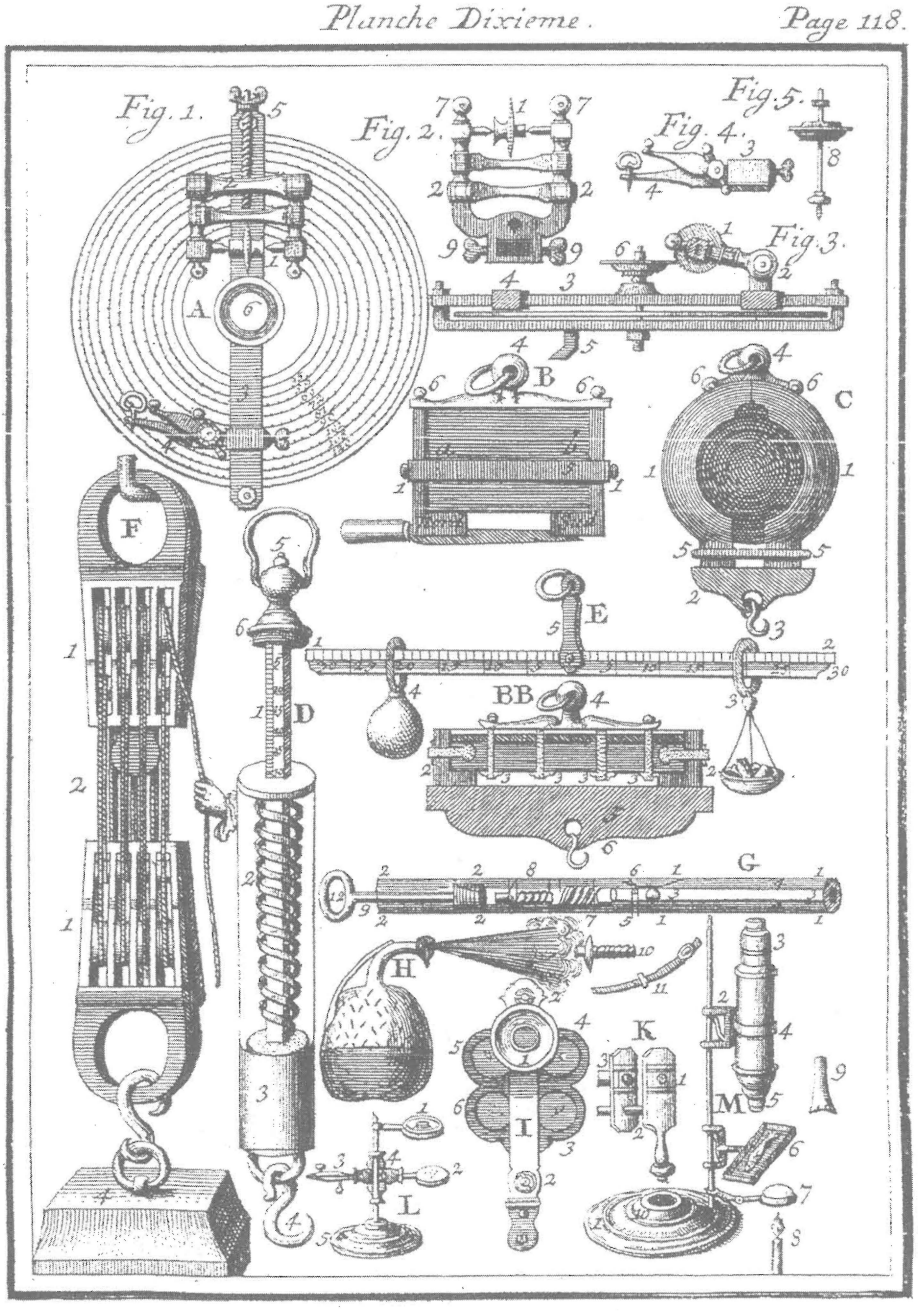
Portrait of Cardinal Portocarrero, by Antoine de Favray. Original, Museum of Fine Arts, Valletta, Malta



An eighteenth-century Pneumatic machine



Moon map, published in Athanasius Kircher's Mundus Subterraneus *(Amsterdam 1665), volume 1, page 62*



An array of scientific instruments, illustrated in N. Bion's Traité *(The Hague, 1723 edition).*

Particularly intriguing is the reference to a depiction of the surface of the moon on cardboard. To date this constitutes the earliest-known reference to any such item on the island. Selenography, or the study of the surface characteristics of the moon, became established following Galileo's telescopic observations during the first decade of the seventeenth century. Galileo himself published a number of such moon maps in 1610. Galileo's moon maps were followed by others published throughout the seventeenth and eighteenth centuries. These included the moon maps of Johannes Hevelius (1647), Eustachio Divini (1649), Francesco Grimaldi and Giovanni Battista Riccioli (1651), Christoph Scheiner (1665), Robert Hooke (1665), Gian Domenico Cassini (1679), Francesco Bianchini (1728) and Tobias Mayer (1748 and following). Scheiner's map was published by the renowned Athanasius Kircher in his *Mundus Subterraneus* (Amsterdam 1665). Unfortunately, the sketchy description of the public library's moon map does not allow its identification with any of the above. The word *disegno* in its description indicates that the map was probably hand-drawn rather than printed.

The Order's Chapter-General held under the auspices of Grand Master de Rohan in 1776 gave the public library its official status as well as a set of regulations.[8] These also referred to the non-book collections within the library. Such collections, including that of scientific instruments, was to be further developed by applying the same rule for books, that is that such instruments found in possession of deceased members of the Order were to be passed on to the public library collection, rather than be sold off unless their late owner had died in debt.[9]

The last traced reference to the presence of the scientific instrument collection in the public library is actually the 1776 one mentioned above and at this point one can only speculate about the eventual fate of the collection. Thus, while a number of visitors' accounts refer to the public library and its collections between 1776 and June 1798, none of them seem to mention the existence of the scientific instrument collection. The descriptions by Navarro (1778),[10] St Priest (1791),[11] Torre di

[8] 'Memoria sopra la pubblica Biblioteca di questa Sagra Religione Gerosolimitana'. A[rchive of the] O[rder of] M[alta] 312, ff. 375–7v. The document is dated 26 November 1776.

[9] 'È di più arrichita [the public library] d'un nascente Museo, dove per utile, e servigio de' Studiosi, e Dilettanti si conservano diversi Stromenti Matematici, varie rare antichità, ed alcune produzioni attinenti alla Storia Naturale. Ma sopra tali, e simili Raccolte non v'è per anche stabilita cosa alcuna a di loro avvanzamento. Sarebbe molto convenevole che si accordi per queste quel tanto, ch'è stato concesso per i libri, vale a dire far unire a questo Museolo gli Stromenti Fisici, e Matematici, le Anticaglie, e le Produzioni Naturali che sarebbero per trovarsi ne'Spogli non perdenti de'nostri Religiosi: tanto più che simili cose poco, o nulla profittano d'ordinario al Venerando Comun Tesoro, e sono al contrario bisognevoli, e decorose in questo Stabilimento.' Ibid., f. 376v,

[10] G. Navarro, *Dissertazione sopra tre bassi-rilievi di marmo bianco . . .* , Malta, 1778.

[11] F.E. de Guignard, comte de Saint Priest, *Malte par un voyageur françois*, Malta, 1791.

Rezzonico (1793)[12] and Pavels (1797),[13] while referring to the presence of antiquities in the public library do not contain the slightest mention to the presence of scientific or mathematical instruments. As described by Ciantar, the collection may not have been on public display and hence would have gone unnoticed by casual visitors to the library premises. However the possibility that the collection was dispersed prior to June 1798, perhaps sold off by the Order during the years of severe financial crisis resulting from the French Revolution, though unlikely, cannot be altogether excluded. Grand Master de Rohan's personal interest in the sciences may have resulted in some of the library's instruments to be transferred to the Grand Master's palace. In April 1781 four telescopes are documented to have been in the palace,[14] while three microscopes were to be found in de Rohan's private study upon his demise in 1797. This small collection comprised a solar and a lunar microscope.[15] Although the provenance of de Rohan's instruments is not recorded, the public library collection did comprise a variety of telescopes as well as microscopes, including a solar one.

It seems more probable, however, that the loss of the public library instrument collection was in some way related to the momentous political upheavals between June 1798 and September 1800 when the islands passed under three different administrations in rapid succession.[16] That the public library – still in its old and semi-ruinous *Forfantone* premises – was subjected to losses during that period is confirmed by contemporary documentation. While Boisgelin estimated that in 1790 the library contained some 60,000 volumes,[17] Domeier gives the figure of 30,000 in 1810.[18] Official documentation during the French period moreover sheds light as to what may have actually been the fate of the instrument collection. On 4 June 1800 the French authorities, blockaded within Valletta by the Maltese insurgents aided by the British, authorised Gioacchino Navarro to sell a number of the more modern gold and silver medals within the library collection since that institution

[12] J. Eynaud (ed.), *Carlo Castone di Rezzonico, Viaggio di Malta anno 1793*, Malta, 1989.

[13] S. Sørensen, J. Schirò (eds), *Malta 1796–1797: Thorvaldsen's visit, based on the unpublished diary of Peder Pavels*, Malta, 1996.

[14] F. Ventura, *L-Astronomija f'Malta*, Malta, 2002, p. 141. The original reference, in AOM 1073, f. 13, refers to three 'cannocchiali' and a 'telescopio'. Ventura remarks that the first-mentioned were possibly refractive telescopes, having lenses at both ends, while the last-mentioned was possibly a reflective telescope, having a circular mirror at the back instead of the front lens.

[15] 'migroscopio solare e un altro lunare . . . altro ordinario', AOM 926, f. iv.

[16] Alexander Ball about the situation he found in Valletta immediately following the expulsion of the French, 'You are aware, Sir, that on the surrender of La Valette by the French, after a two-year blockade and siege, every department of the Government was, of course, thrown into the utmost confusion.' N[ational] A[rchives] M[alta] Gov 1/1/3, p. 132.

[17] L. de Boisgelin, *Ancient and Modern Malta*, London, 1804, vol. 1, p. 37.

[18] W. Domeier, *Observations on the climate, manners and amusements of Malta . . .* , London, 1810, p. 41.

was totally starved of funds.[19] The possibility that the instrument collection shared the same fate either some time before or after that date constitutes one of the more likely possibilities. If not sold by either the Order or the French, the wholesale pilfering of the collection either by the departing French, the British or by the Maltese themselves around late 1800 remains the most plausible explanation for the loss of what might otherwise have been a stupendous collection and the basis for a Science Museum of Malta. Absolutely no reference to the existence of scientific or mathematical instruments in the library's collection was made during the transfer of the library to its present premises in 1812 or indeed in any description of the library both prior and following that date.[20]

The Jesuit College collection

The establishment of a class of mathematics at the Jesuit College in 1655 resulted in the gradual building-up of a similar collection of instruments, even if on a more modest scale.[21] Moreover the actual use of such instruments is in this case documented. In June 1747 a public philosophical disputation was held in the Jesuit church in the presence of Grand Master Pinto himself. A number of experiments were conducted which necessitated the utilisation of a pneumatic machine. The participants included knight Sinzendorf and the rector of the Seminary, Gauci.[22]

On 24 April 1768 the collection of instruments pertaining to the class of mathematics was inventoried like all the other Jesuit property in view of their expulsion from Malta.

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[19] The decision of the French Government Commission in this regard, dated 4 June 1800, 'La Commission considerant que malgré la strict economie avec la quelle le Citoyen Navarro Bibliothecaire de la Biblioteque publique a dirigé jusqu' ici les depeuses de ce Dépot Literaire, les fonds destitues à son entretien se trouvent épuisés depius plusiers mois: Arrête: Que le dit Citoyen Navarro continuera jusqu' à la termination de la crise ou nous noustrouvous de faire face aux dites dépenses en procédant ainsi qu'il l'a dejà fait (d'apres notre autorisation verbale) à la vente de certaines médailles d'or ou d'argent des plus modernes et par consequent des moins précieuses à conserver.' AOM 6523e, pp. 86–7.

[20] For a contemporary published description of the public library's transfer to its present premises in 1812 see *Giornale di Malta*, issue 22, dated 3 June 1812, p. 88. While this description again refers to the collection of antiquities in the library, absolutely no mention is made of the presence of any scientific or mathematical instruments.

[21] On the establishment of the class of mathematics in the Jesuit College see S. Fiorini, 'The Development of Mathematical Education in Malta to 1798', in S. Fiorini, V. Mallia-Milanes (eds.), *Malta: A Case-Study in International Cross-Currents*, Malta, 1991, pp. 122–8.

[22] Inquisitor Passionei to Secretary of State, 'Coll'assistenza del Signor Gran Maestro, a cui era dedicata, si tenne pubblica disputa filosofica Giovedì scorso alla Chiesa de Padri Gesuiti, e fecero parecchi sperimenti colla macchina anche Pneumatica, e il tutto riusca con soddisfazione dell'Eminenza Sua. Vi argomentò il primo il S. Cavaliere Sinzendorf, e fece prova del suo spirito, e della sua erudizione, e per terzo il P. Gauci, Rettore del Seminario, uomo di gran letteratura.' A[rchivio] S[egreto] V[aticano] S[egreteria di] S[tato] M[alta], 114, f. 175v, dated 24.6.1747.

Table III
List of instruments found in the room of the lecturer of mathematics in the Jesuit College: 25 April 1768[23]

Un stucchio con vari stromenti matematici da tavolino.
Un altro piccolo stucchio con altri stromenti matematici d'argento di diversa specie.
Una machina detta Pneumatica.
Alcuni tubi piccolo di cristallo.
Altri pochi cristalli, e globi di legno.
Un globo grande o'sia sfera armillare di legno, quale il Padre de la Madalena disse di non curarsene riportando seco, anzi di volerlo lasciare, benchè sia suo proprio.
Più un barometro, che il medesimo Padre disse esser suo, e di non volendo trasportare seco, anzi d'aver tutto il piacere di lasciarlo nel luogo dov'è.

It seems that the college's collection of mathematical and scientific instruments was further developed following the transformation of the institution into a University of General Studies, in 1769. Inventories dated 1771 and 1773 provide detailed lists of the collection.[24] Among the more intriguing items listed one finds electrical machines, a magic lantern, an armillary sphere based on the Copernican model, Magdeburg hemispheres and even what seems to have consisted of a kite in the form of a flying dragon made from green velvet. In 1772 more instruments were acquired for the use of the class of Physics at the same institution. Not only are the instruments listed, but specific reference is made to a 'room for experiments' at the university.[25] Documentation from the French period confirms the survival of the university's collection, at least in part, up to that point. During its session of 14 December 1798, that is three months following the start of the Blockade, the French Government Commission ordered that the moveable property of that institution be put under seal. This included the 'cabinet of physics and mathematics', the contents of which were however not described.[26] Again, the eventual fate of this instrument collection is shrouded in mystery.

Aerostatic experiments

The success enjoyed by the Montgolfier brothers in June 1783 in managing to get a hot-air balloon some 1,800 metres up in the air soon resulted in nothing less than a balloon craze practically all across Europe. Experiments with balloons in Malta are

[23] AOM 1993, f. 14v.
[24] AOM 1994, ff.27r-v, 70v-1v, 106v-7, 111r-v. These inventories have been referred to by G. Bonello (1992), p. 25.
[25] 'machine, e stromenti fisici nuovamenti fatti in quest'anno 1772 per uso della Scuola di Fisica, esistenti nella camera degli Esperimenti del Colleggio.' Ibid., f. 27v.
[26] AOM 6523c, p. 327.

now known to have taken place as early as April 1784, and possibly before. In his correspondence with the Cardinal Secretary of State dated 1 May 1784, Inquisitor Chigi Zondadari remarked that various attempts at using balloons had already been made on the island, drawing the admiration of the public. Other attempts were moreover being prepared.[27] One such previous attempt referred to must have been that carried out on the initiative of the Balí des Barres on 8 April 1784 and which was reported in the *Journal de Paris* of 26 May:

Yesterday a balloon was launched from the residence of Balí des Barres. The balloon had a height of nine feet and a diameter of six and was constructed by Monsieur Amic, a physician in the service of the King's Navy Department. The balloon rose ascended vertically, reaching a height of between 350 and 400 toises [between 700 and 800 metres] in two minutes. Were it not for a rather strong western wind the balloon would have gone up even higher. Blown towards the east for about ten minutes, the balloon landed on the rocks around Fort St Elmo from where it was recovered by a passing ship.[28]

Interestingly Monsieur Amic claimed to have been a pupil of Mesmer, the originator of 'animal magnetism', of which more below and he was in fact applying that sort of medical treatment to various individuals on the island, including the Balí des Barres himself.[29]

A somewhat more elaborate aerostatic attempt was that carried out on 5 November of the same year, using a much bigger balloon. A detailed description of that extraordinary event has been traced in the Inquisitorial correspondence and freely translated runs as follows:

Last Friday two Italian knights, Miari from Venice and Ruggi from Salerno conducted an experiment with an aerostatic balloon that proved of great satisfaction to those present. The experiment was conducted from the courtyard of the magisterial palace and in the presence of the Grand Master and almost all the members of the Order. The balloon was wholly constructed of paper and its shape consisted of a cylinder with a pyramid at both ends. The cylindrical part was a third less in height than

[27] Inquisitor Zondadari-Secretary of State, 'Essendosi ridotte l'esperienze de Palloni aerostatici quasi un mecanismo, onde in certa maniera quasi sicuro sia l'effetto procedente da alcuni dati principi; ed essendosi introdotta la moda di fare per tutto de Palloni; anche in quest'Isola vari ne sono stati fatti con sodisfazione del Pubblico; e vari altri se ne stanno preparando.' ASV SS Malta, 141, ff. 207v-8, dated 1.5.1784.

[28] Burau-Senac reproduces a facsimile of the original news item in French as featured on page 640 of the issue and accompanied by a translation in English: 'Extrait d'une Lettre de Malthe du 9 Avril 1784. Messieurs, Il a été lancé hier de l'hôtel de M. le Bailli des Barres, un Ballon de neuf pieds de hauteur sur six de diamètre, construit par M. Amic, Médecin du Roi au Département de la Marine. Ce Ballon s'est élevé en 2 min. à-peuprès verticalement jusqu'à la hauteur de 350 à 400 toises; sans un vent d'ouest assez violent, il se seroit élevé infalliblemnet plus haut. Il a couru vers l'est, suivant la direction du vent, & il est tombé, après dix minutes, sur les roches qui bordent le fort St. Elme, & en a été retiré par une barque qui passoit.' C. Burau-Senac, 'Early aeronautics in Malta', in *The Sunday Times* [of Malta], dated 15.4.2001, p. 16.

[29] P. Cassar, *Medical History of Malta*, London, 1964, pp. 146–9.

the pyramids at its ends. Its circumference exceeded sixty feet while its height totalled some forty feet. Its ascent, although not actually calculated, seems to have reached some 600 feet and it remained in the air for about twenty minutes. Due to the lack of wind it only moved a little more than half a league. The southwesterly breeze however resulted in the balloon ending up in the sea. Notwithstanding its considerable size, the balloon was refilled and went up again from where it had started in less than four minutes.[30]

The shape, dimensions and the material used for construction of the Miari/ Ruggeri balloon were typical to others of the period which were being launched throughout Europe and the experiment confirms the immediate reflection of European technological advances on the island during the period, and particularly de Rohan's interest and patronage where the sciences were concerned.[31]

Astronomy

Studies in astronomy are known to have been carried out by students of the Jesuit College, and occasionally these were even published. An early example of this was Carlo Farrugia's treatise. Farrugia, a Maltese conventual chaplain who was subsequently to reach high political office as *uditore* to Grand Master Pinto, presented a public disputation which was published in the form of a 98-page work entitled *Assertiones mathematicæ, ac philosophicæ ex Elementis Geometricis, Cosmographicis, & Astronomicis, Opticis, Mechanicis ex universa Aristotelis Philosophia selectæ*. In his work, published in Messina in 1719, Farrugia discusses, among other, the Copernican and the Tychonian systems, referring to the former as false, being in contradiction with the scriptures and condemned by the Church. Farrugia's work, of which only one copy is known, merits a study on its own.[32]

The establishment of teaching institutions of navigation and mathematics by the Order resulted in more attention being devoted to astronomy. Giovanni Pagnini, a native of Lucca but resident in Malta for many years, published his *Trattato della*

[30] Inquisitor Zondadari-Secretary of State, 'Dai 2 Cavalieri italiani Miari, veneziano, e Ruggi di Salerno nel passato Venerdì fatta esperienza nel cortile del palazzo magistrale d'un Globo Aerostatico, che riuscì della maggiore soddisfazione, alla presenza dell'Eminentissimo Gran Maestro, e di quasi tutta la Religione. Il detto Globo era formato tutto di carta rappresentando una figura irregolare perchè erano due Piramidi unite oppostamente ad un cilindro di un terzo meno di longhezza. Era di sopra sessanta piedi di circonferenza, e circa quaranta di altezza. La di lui elevazione, sebbene non fosse calcolata si fa ascendere a 600 piedi; si trattenne in aria circa ventun minuto; e per mancanza di vento non camminò, che poco più di mezza lega; quel poco però di vento che vi era, essendo al sud ovest, fece si che cadesse in mare. Sebbene fosse una machina così grande fu riempito, e si elevò dal luogo dell'esperienza in meno di quattro minuti.' ASV SS Malta, 141, ff. 284v-5, dated 6.11.1784.

[31] The M*usée des Ballons*, housed in the chateau de Balleroy in Normandy contains a vast collection of material pertaining to eighteenth-century ballooning.

[32] A copy of this work is housed in the rare books section of the Melitensia, University of Malta Library. A manuscript ex-libris note on the title page indicates the copy to have been in possession of Emmanuele Borg Olivier.

Sfera ed introduzione alla navigazione per uso de' piloti. The book was published in Venice in 1750 and contains, among other, a detailed exposition of the four major systems explaining the structure of the universe, namely the Ptolemaic, Copernican, Tychonian, and the Semicopernican one. Pagnini, who described himself as *professore d'Idrografia in Malta nel servigio della Sacra Religione Gerosolimitana*, opted for the Semicopernican system as the most credible one.[33]

Pagnini's choice, like that of all Catholic scientists of the time, was certainly conditioned by the Church's continued condemnation of the Copernican system down to the first decades of the nineteenth century. Particularly interesting in this context is the evidence given in front of the Maltese inquisitorial tribunal in May 1770 by Michel Angelo Parnis, a former student of navigation:

> While studying navigation, Giuseppe Aloisi, now a slave in Constantinople, and I, came to know about the Copernican system regarding the motion of the Earth and the immobility of the Sun. Henceforth we considered this as being more acceptable than the system upheld by the Church, namely that the Earth is immobile while the Sun is in motion.[34]

Parnis' voluntary self-denunciation to the Inquisition may have resulted out of genuine pangs of conscience or else of fear that someone else might eventually denounce him. In either case the episode constitutes early evidence of the questioning of the anti-Copernican, Church-held view by Maltese individuals.

One of the most remarkable scientific developments in Malta during the latter part of the eighteenth century was the establishment of an astronomical observatory in the Grand Master's palace. This totally forgotten episode has been brought to light by recent research published by Frank Ventura.[35] It seems that the French knight and naturalist, Deodat de Dolomieu was instrumental in convincing the Grand Master to initiate such a project.[36] Dolomieu had, in fact, published a study on the climate of the island in which he pointed out its suitability as a place of observing the skies.[37]

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[33] For a detailed study of Pagnini's work see F. Ventura, *L-Astronomija f'Malta*, Malta, 2002, pp. 130–9. Pagnini also published a work entitled *Costruzione ed uso del compasso di proporzione*, Naples, 1753.

[34] 'Studiando nautica io e Gioseppe Aloisi maltese, oggi schiavo in Costantinopoli, avendo sentito il sistema di Copernico circa il moto della terra, e stabilità del sole, habbiam stimato più accettabile quello che l'altro accettato dalla Chiesa che la terra si immobile, e mobile il sole.' A[rchive of the] I[nquisition] M[alta] Proc.[essi] Crim.[inali] 129, case 143, dated 6.5.1770.

[35] F. Ventura, 'Grand Master de Rohan's Astronomical Observatory (1783–1789)', in *Melita Historica*, x, 3, Malta, 1991, pp. 245–55; *L-Astronomija f'Malta*, Malta 2002, pp. 141–53. See also W. Soler, 'The Knights' Astronomical Observatory and the Palace Tower', in *Palace of the Grand Masters in Valletta*, A. Ganado, (ed.), Malta, 2001, pp. 109–17.

[36] F. Ventura (2002), p. 141.

[37] D. de Dolomieu, *Voyage aux iles de Lipari, fait en 1781, ou notices sur les iles Aeoliennes, pour servir à l'histoire des volcan; Suivi d'un mémoire sur une espece de volcan d'air,& d'une autre sur la température du climat de Malthe* . . . , Paris, 1783. On page 286 of his bibliography, F. de Hellwald gives the following entry: *Essai sur la température du climat de Malte*, Paris, 1783. This may indicate that the part describing the climate of Malta was also published on its own.

The observatory premises were set up between May and October 1783 and detailed information regarding the purchase of the scientific equipment required has survived. By September 1785 the observatory was very well equipped with an array of scientific and mathematical instruments bought from France, England, and Switzerland at a cost of over 11,000 scudi. Such equipment included a large quadrant from France, an English achromatic telescope together with a hygrometer and a thermometer, the latter two purchased from Geneva. Moreover a telescope seems to have been constructed locally. On Dolomieu's suggestion, the Grand Master appointed the French Jean-Auguste Dangos, a native of Tarbes, as resident astronomer and the latter arrived in Malta in May 1783.[38] Observations carried out were recorded in registers as well as occasionally published in learned periodicals of the period, notably in the *Journal des Sçavans*.[39] In June 1788 Dangos intended to visit Mount Etna. The objective of this visit was communicated by Inquisitor Gallarati Scotti to the Papal Secretary of State, with the inquisitor adding a caustic remark about the political situation at the time:

> The astrononer, knight D'Anglos (*sic*), will soon be leaving for Mount Etna in Sicily in order for him to refine his findings on the lunar world, namely to confirm the existence of volcanoes on the moon, in much the same manner that these exist on the sublunar world. There are those who believe that this would not be such a great discovery, since it is reasonable to assume that every world has its own volcanoes; in so far as the political world has its own, it would be more profitable for one to try to calculate when these are about to erupt.[40]

The end of the observatory occurred on 14 May 1789 with its destruction by a fire, probably as a result of lightning. A description of this dramatic occurrence, written the following day runs as follows:

> In the past days a fire occurred in the observatory erected in the middle of the Magisterial Palace; it has not resulted in any serious consequences, however all the elaborate instruments were damaged as well as the registers that were in part housed there by the knight D'Anglos [sic] who serves his Eminence the Grand Master in that capacity [as astronomer].[41]

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[38] Inquisitor Zondadari-Secretary of State, 'arrivato il noto uffiziale Astronomo, che monsignor de la Lande ha mandato al Signor Gran Maestro per ordinare la specula, che l'Eminenza Sua vuol far costruire.' ASV SS Malta 141, f. 60r-v, dated 24.5.1783.

[39] F. Ventura (2002), pp. 142–51.

[40] Inquisitor Gallarati Scotti-Secretary of State, 'Quanto prima partirà per Sicilia il Cavaliere D'Anglos, Intendente di Astronomia per trasferirgli al Monte Etna a perfezionare le sue speculazioni nel mondo lunare dove crede dimostrabile, che vi sieno de'vulcani, come nel mondo sublunare. Qualcuno crede che non sarebbe una gran scoperta che si possa con ragione fissare che ogni mondo v'ha i suoi Vulcani; tanto chè avendo il Mondo Politico i suoi, di questi sarebbe più proficuo calcolare le eruzioni.' ASV SS Malta 144, f. 152v, dated 7.6.1788.

[41] 'Ne scorsi giorni è seguito un incendio nella Specula che s'innalza in mezzo al Palazzo Magistrale; ma non ha avuto questo conseguenza, ma tuttavia vi è stato il danno di tutti gli ornati machine, e Registri d'osservazione, che quivi venivano conservate in parte dal Cavaliere D'Anglos, che serve l'Eminentissimo Gran Maestro in tal ispezione.' Ibid.,145, f. 49, dated 14.3.1789.

While all the equipment seems to have been destroyed, two separate sources indicate that the registers of observations survived, at least in part. These, however, have not been traced to date in Malta or in Tarbes, Dangos' native town, and to which he returned after 1789.[42] While it is evident that the observatory was never reconstructed, the discovery in 1816, of astronomical instruments which were concealed in an entresol of the palace tower may indicate that some sort of astronomic activity continued to be pursued there after the 1789 disaster. The instruments were discovered by Captain William Henry Smyth of the British Navy but their eventual fate is unknown.[43] In 1848 Smyth presented a manuscript portulan, compiled by the Maltese Lorenzo Mifsud in 1772, to the British Museum and the possibility that the instruments discovered in 1816 might have been similarly donated is worth exploring.

Climatic observations

Besides his work as a naturalist, a pursuit which was reflected in his impressive collection of natural history material, Dolomieu had his observations on the climate of Malta published in 1783.[44] The presence on the island of instruments measuring the temperature and rainfall is moreover documented from other sources. In 1767 what seem to have consisted of texts to be utilised for the production of thermometers were printed in the Grand Master's printing press.[45] During late August 1780 a heat wave hit the island. On that occasion the Réaumur thermometer in the inquisitor's palace was recorded to have marked a temperature of twenty-five degrees notwithstanding it being dawn and with the windows of the room left open. Such a temperature is equivalent to slightly over thirty-one degrees Celsius and is one of the earliest recorded temperature readings for the island.[46] In March 1790 readings taken from a rain-measuring machine confirmed that the amount of rainfall had been typical for the period.[47] The taking of rain measures for Malta on a fairly regular basis has to date been thought to have started during the late 1830s[48] and the presence and use of

[42] F. Ventura (2002), p. 148.

[43] W. Soler (2001), p. 112.

[44] See above.

[45] Undated printing commission: 'Si è stampato per ordine di [blank] in quinterni due carta di Napoli il Termometro.' AOM 2048, f. 4v, item 18. The handwriting, however, puts some doubt as to the correct reading of the word 'Termometro'. The same source, f. 13v, gives the cost of the printing commission as 2 scudi 2 tarì.

[46] Inquisitor Zondadari-Secretary of State, 'Abbiamo caldi straordinari. Il termometro con la scala di Réaumur è situato nella notte in stanze a finestre aperte; si mantiene anche nell'ore del far del giorno a 25 gradi.' ASV SS Malta 139, f. 277, dated 26.8.1780.

[47] Inquisitor Gallarati Scotti-Secretary of State, 'a segno che con la Machina di esperimento si è calcolato aver piovuto quanto ordinariamente piove.' Ibid., 146, f. 43, dated 6.3.1790.

[48] P.K. Mitchell, 'Pioneer rainfall observations in the Maltese islands', in *Melita Historica*, iii, 3, Malta, 1962, pp. 59–64.

some form of rain-measuring apparatus in eighteenth-century Malta is yet another confirmation of local scientific interest during the period.

Other scientific pursuits

The study of medicine – particularly given the Hospitaller role of the Order – was always at the forefront where local attention to science was concerned. An impressive number of Maltese were sent to study medicine and surgery abroad, notably at Montpellier. Developments on the continent, whether based on sound scientific research or otherwise, were quick to reach the island. Perhaps the most remarkable example of the latter was the 'animal magnetism' craze which had reached the island by 1783 and which was reported to have reached obsessive proportions.[49] The scepticism expressed towards that form of treatment in the report by Maltese physicians commissioned by de Rohan and submitted in December 1783 actually preceded its outright condemnation by a French medical commission appointed by Louis XVI in March of the following year.[50]

Interest in the natural sciences was demonstrated by both Maltese as well as by resident members of the Order and other foreigners residing on the island. The study and interpretation of fossil finds on the island gradually moved away from pseudo-religious speculation towards a more scientific interpretation. Collections of items of natural history were created, perhaps the most extensive of which was that owned by Dolomieu. The latter's collection seems to have been taken out of Malta in April 1791 when Dolomieu left the island.[51] Dolomieu was to return to the island with Napoleon in June 1798 and it seems that his collection was at some point brought back over to Malta. Indeed General Vaubois successfully petitioned General Graham for the Dolomieu collection to be sent back to France following the French capitulation in September 1800. The collection was actually dispatched there on board the British ship *Triton*.[52] The description of Maltese flora and fauna on a scientific basis was another area of scientific pursuit. An early local attempt at this was carried out in 1689 by Filippo Cavallini, a Maltese doctor of medicine and conventual chaplain.[53] In 1742 the Maltese apothecary Vincenzo Lagusi published his *Erbuario Italo-*

[49] Inquisitor Zondadari-Secretary of State, 'Siccome però in Malta aveva causato [il magnetismo animale] un fanatismo singolare.' ASV SS Malta 142A, f. 59v, dated 7.5.1785.

[50] See P. Cassar (1964), pp. 144–9.

[51] Inquisitor Gallarati Scotti-Secretary of State, referring to Dolomieu's imminent departure from Malta, 'avendo già incassate tutte le produzioni di storia naturale, che aveva nel suo museo, qual'circostanzi fa credere che non abbia egli intezione di ritornare almen per molto tempo in Convento.' ASV SS Malta 147, f. 76, dated 9.4.1791.

[52] W. Soler (2001), p. 117, fn. 31.

[53] F. Cavallini, *Brevis enumeratio Plantarum* . . . , Rome, 1689.

Siciliano. This work, published in Naples, listed various plants as well as medicinal drugs. An anonymous manuscript, dated 1786 describes Maltese flora as well as fish, shellfish, and birds to be found around the Maltese islands.[54]

More unusual was the attempt carried out in 1785 by a member of the Order at producing papyrus-writing material from papyrus plants growing at Fonte Ciane in the vicinity of Syracuse. Knight Saverio Landolina Nava had actually been commissioned by the Neapolitan Court to rediscover the lost art of papyrus production. Landolina Nava is known to have produced a sheet of papyrus 420 by 400 millimetres on which he described the process he used for its manufacture. The document which, albeit in a frail condition, has survived in the National Library of Malta collection, was dedicated to Grand Master de Rohan and also features colour depictions of papyrus plants.[55]

Conclusion

Notwithstanding it being a relatively unexplored area of historical research, the pursuit of science in early-modern Malta, particularly during the eighteenth century, provides ample proof of local intellectual vitality and a close following of scientific developments on the continent. In the scientific sphere as well, early-modern Malta indeed merited Patrick Brydone's description of being an 'Epitome of all Europe'. More research within this field would undoubtedly further confirm the justification of that statement.

[54] NLM Lib. Ms. 1187, entitled *Erbario italiano, maltese e latino con l'aggiunta delle denominazioni di frutti di mare, pesci, e volatili, che si prendano nel territorio, e mare di Malta, e Gozo, 1786*. This manuscript was published by R. Vella Tomlin; see *Melita Historica* iii, 1, Malta, 1960, pp. 5–52.

[55] See W. Zammit, 'An Attempt at Papyrus Production in 1785', in *Treasures of Malta*, iv, 1, Malta, 1997, pp. 73–6.