Windmills and the Production of Gunpowder in Malta

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Abstract: Each and every discussion revolving around the history of windmills in Malta has always and, wrongly so, focused on their exclusive use for grinding wheat and barley, without taking into consideration that some of these windmills, in particular those situated behind the fortified walls (but not only), could have had a dual function; that of being powder mills and machines for the grinding of corn. Old maps of the Grand Harbour have clearly documented the use of windmills in Malta for the exclusive production of gunpowder at the turn of the seventeenth century. For security reasons, gunpowder mills were mostly situated within the city walls. However, in the absence of historical records, the major difficulties are: which of these windmills were used for milling grain? Which had a dual function? Which were used exclusively for producing gunpowder? This paper seeks to answer these questions.

Keywords: Malta, Order of St John, Windmills, gunpowder

At Cospicua, or Bormla as this locality is also known, there are three windmills whose history is still largely unaccounted for. Two of these mills are located next to each other in an area known as the Contrada Santa Margherita. The third one is on the other side in an area known as San Ġwann t’Ghuxa. All these windmills are situated at the edge of the fortification system of Cospicua. These were not the only windmills to be found inside city walls but all the other windmills have been demolished, the last being those in Valletta towards the end of the nineteenth century. According to the surviving records, in particular old written attestations, maps, paintings and photographs, the presence of windmills behind the walls overlooking the Grand Harbour can be dated to circa 1533. In other words, their history ran parallel with the
construction of our fortified towns and the heavy gunpowder machines that were introduced into Malta with the arrival of the Knights of St John in 1530.

The first gunpowder mills in Malta

When Philippe A. Le Lourd wrote his seminal study on the history of windmills in Malta, he noticed a striking difference between the windmills in the countryside and those in the harbour cities. While those in the cities lay within the urban network, the ones in the countryside were located outside the residential core.1 While there should be no doubt that the windmills situated all over the Maltese and Gozitan countryside were used for grinding grain, those windmills situated within the urban fabric might have had a totally different use. Unfortunately, since documentation regarding their usage is sparse and rudimentary, their history can only be reconstructed by referring to collateral evidence and the surviving snippets of information should be analysed within the context of the needs of Early Modern Malta.

Judging from old maps and prints of Malta, the first windmill appears to have been built on the peninsula of Senglea. At least, Johannes Quintinus attests to the presence of a windmill exactly on Senglea’s peninsula in the map of Malta reproduced in his Insulae Melitae Descriptio which was published in 1536 although the author had visited the island in 1533.2 This windmill must have been constructed by the Knights of St John, on a piece of land that belonged to the Order, immediately after they settled in Malta.3 In the following years another windmill was built in the same locality attesting to the increase in demand for wind power. In fact, by 1565, Senglea had two fully-fledged windmills; quadrangular stone blocks holding a base tower, with six blades even though the engravers showed only four, – a direct influence on the engravers of the Northern

European type of windmill – attached to six spokes around the shaft. A wooden grid was attached to each of the blades onto which a cotton sail was then affixed. An internal mechanism moved a limestone bed. These two windmills are again illustrated in Great Siege maps and engravings, as well as in paintings depicting the siege. Moreover, Giacomo Bosio and Francesco Balbi da Correggio both mention a mill in Fort St Angelo in Birgu, although this was a powder mill.

During the siege of 1565 there were therefore three mills in full operation which were, however, removed over the years. Population growth led to a new urban zone in Senglea that brought about the demolition of the two windmills on this peninsula to allow new urban dwellings. The powder mill at Fort St Angelo, extensively damaged during the siege, was rebuilt when the fort was repaired and subsequently enlarged.

Immediately following the siege, the knights focused all their efforts on building a new city on Mount Sciberras. Early maps showing the design of this new city indicate the presence of a powder mill. In 1582 Matteo Perez d’Aleccio includes a powder mill within the limits of the new city in his map of 1582. Listed in Italian as molino da polvere, this mill is sited within Fort St Elmo. It was built on the highest point in the fort, at right angles to the inward bastion, a few metres away from the polverista or gunpowder store. The same gunpowder mill appears again in the same location in the German map of Daniel Specklin, published in 1585, and which followed Perez d’Aleccio’s map. The powder mill features again in Francesco Dell’Antella’s map published in Rome in 1602. Dell’Antella also places the powder mill in the same area indicated by Specklin on one of the bastions of Fort St Elmo, making slight corrections and alterations. While Perez D’Aleccio and Specklin featured Valletta’s planned architectural buildings, including those that failed to materialize, such as the planned arsenal within the city walls, Dell’Antella showed only those constructions that were actually built.

4 Albert Ganado and Maurice Agius-Vadalà, *A Study in Depth of 143 Maps Representing the Great Siege of Malta of 1565* (Malta,1995), ii, 50.
5 Matteo Perez D’Aleccio, Frescoes showing scenes from the Great Siege, The President’s Palace, Valletta.
6 Albert Ganado, *Valletta Città Nuova* (Malta, 2003), 437.
7 Ibid., 444.
8 Ibid., 457.
9 Ibid., 557.
Which windmills were used as gunpowder mills?

These images in Perez d’Aleccio, Specklin, and d’Antilla present the same type of windmill. Their maps give a clear idea about the external structure of the powder mill. It was a truly large windmill, consisting of a tall tower with a mill inside running on wind power through the use of six sails. The Senglea windmills had a similar structure. One would be making a correct historical argument if one were to begin to associate these two old mills at Senglea with the production of gunpowder rather than the grinding of grain. The model of gunpowder mills in Malta, operating through the force of the wind, was so successful that it was copied and used for the milling of grain without excluding the construction of more gunpowder mills. Scholars agree that the windmills of the Maltese Islands are closely associated with the presence of the Knights of St John in Malta at a time when gunpowder was in great demand.

The two old windmills in the siege maps are located towards the edge of the peninsula and distant from the countryside. It makes no sense to locate a mill for the grinding of grain here, unless one wants to argue that these were built for the grinding of imported wheat and barley. Farmers would have preferred to make use of smaller mills closer to their fields, since it was extremely fatiguing to transport wheat to the corn mills within cities.

Besides, these mills were built on land belonging to the Order of St John. All over Europe and the Mediterranean it was customary for the production of gunpowder to be considered a State monopoly. In Malta the custom was for these windmills to be rented out to third parties who were also responsible for their maintenance. Hence one may conjecture that the system here was the same as that used for the milling of grain. The State would purchase the production of gunpowder from the tenants but, at the same time, it would be up to the tenant to procure the necessary wood for the production of gunpowder. Therefore, it is more than correct to associate these mills in Senglea with the production of gunpowder, a primary material much in demand by all the fortified cities of Early Modern Europe.

10 Ganado and Vadalà, 50.
Andrew P. Vella refers to the introduction of animal-driven mills at the time of Grand Master Claude de Le Sengle, when ‘the Palermitan engineer Vincenzo Vogo came to Malta and introduced a type of mill driven by animals, known as “centimoli”’ and this ‘made milling possible throughout the year at a cheap price’. Vella’s historical reference was taken to mean that the windmills that existed in Senglea prior to the siege were upgraded and refitted in such a way that they could function with both wind and animal power. However, any correlation of this event with the windmills is not acknowledged. Vella never referred to wind-driven mills. More importantly, throughout the entire rule of the Order, the windmills and the mills driven by animals fell under distinct legal categories. The first was a State monopoly; the second type could be a private enterprise. The origins for such a distinction, in particular the State monopoly, and the necessary permission for the construction, can only be explained by these windmills’ potential to be used to manufacture gunpowder.

The presence of such mills within the fortifications was not without its dangers. Perhaps, the Senglea windmills were placed at the edge of the peninsula, around 120 metres away from Fort St Michael, as a military safety precaution, since the presence of a large amount of gunpowder within fortified walls created a great security problem. According to Balbi da Correggio, the small mill at Fort of St Angelo blew up during the siege after it got over-heated. Giacomo Bosio refers to it as ‘molino da polvere’ and attributed the calamity to an accidental fire. He recounts how, as a consequence, the roof of the mill caved in. It also blew up a nearby magazine killing a knight and other personnel in the process. Zabarella mentions the same story, but says that the explosion occurred after the mill had been hit by a Turkish cannon ball and an adjacent gunpowder magazine caught fire.

This was not the only incident when an explosion occurred in Malta in connection with gunpowder production or storage. In his history of the Order, Bartolomeo Dal Pozzo mentions another big explosion that

12 Andrew P. Vella, Storja ta’ Malta (Malta, 1974), 190.
13 Stephen C. Spiteri, The Great Siege Knights vs Turks MDLXV (Malta, 2005), 235.
15 Giacomo Bosio, Historia della Sacra Religione et Illustrissima Militia di S. Giovanni Gierosolimitano, iii (Venice, 1695), 566.
16 Paolo Zabarella, Lo Assedio di Malta (Turin, 1902), 317.
destroyed the gunpowder magazine of Valletta in 1622. Dal Pozzo writes that

One should also mention that famous explosion when a quantity of powder stored in one of the watch towers of the ravelins attached to the counter bastion of Valletta, after having been hit by a thunderbolt at night during a terrible storm that hit the island, caught fire instilling great fear in the inhabitants. In order to avoid similar accidents in the future, large quantities of gunpowder were removed from the stores where they had been stored up to then and they were distributed in several places; some was put in the four watchtowers of St Angelo’s fortifications looking onto the sea and the rest in six rooms built especially for this purpose. 17

The siting of gunpowder magazines in other areas of the harbour did not eliminate the risks of explosions. The Fondo Lanzon, which is a record of events collected by Canon Lorenzo Lanzon at the turn of the nineteenth century, mentions two other explosions in the first half of the seventeenth century. The first one occurred on 11 August 1628, the second one on 17 September 1634.18

Whatever the cause, after a third explosion in 1634, the danger seems to have been completely eliminated. Safety measures around the gunpowder stores improved significantly, while gunpowder slowly began to be stored in appropriate stores purposely built around the new fortifications of the Cottonera Lines and the Floriana Lines. Malta would not experience any further spectacular incidents connected with the storage and manufacture of gunpowder under knights. The next explosion would occur at the beginning of British rule when the gunpowder warehouse in Birgu exploded on 18 July 1806,19 destroying all the surrounding buildings and killing over 400.20

17 Bartolomeo Dal Pozzo, Historia della S. Religione Militare di S. Giovanni Gerosolimitano detta di Malta (Venice, 1715), ii, 302. ‘Occorse pure di notabile l’incendio di una quantità di polvere conservata in una delle guardiole de’ rivellini congiunti alla contra scarpa della Valletta che seguì alla caduta di un folgore in tempo di notte e d’un terribile temporale con iscossa dell’isola espavento infinito degli abitanti. Onde per evitare in avvenire semili infortuni, le vossi la polvere da i magazini dove conservansi in gran quantità e si distribui in più luoghi riponendolo parte nelle quattro guardiole della fortificazioni del mar di san Angelo e parte in altri sei camere che si fabbricarano apposta.’
18 Archivum Collegii Canonicorum Victoriosae, Fondo Lanzon, Tomo 4, 705.
19 Ibid., Tomo 3, 413.
20 Alexander Bonnici, L-Isla Fi Ġrajjiet il-Bazilika- Santwarju ta’ Marija Bambina (Malta, 1991), iii, 81–2.
A new set of measures concerning the storage of gunpowder was introduced with the construction of lines of fortifications enclosing Cospicua during the rule of the Cotoner brothers: Raphael (1660–63) first and his brother Nicholas (1663–80) later. Nicolas Cotoner also took the initiative to build a number of windmills, some of which in the harbour area used to serve for the production of gunpowder that would be stored in the apposite magazines.

Nicholas Cotoner added two new windmills a few metres away from each other on St Michael bastion in Valletta although their exact date of construction is not known. These mills survived until almost the end of the nineteenth century. One may argue that these windmills were built to accommodate the needs of the Order’s bakeries which were situated in a big block a few metres away. The windmills of Valletta can be seen in more than one old photograph. One particular photo shows one of the windmills in full working order. This photo confirms that these two windmills were being exclusively used to produce charcoal powder. One cannot imagine a windmill used to mill wheat and barley surrounded by pallets of cannonballs and other ammunition!

It is not clear when the windmill on Fort St Elmo was demolished but this must have taken place during the seventeenth century. The date of demolition could establish whether these two windmills in Valletta were constructed as a result of St Elmo’s windmill being pulled down or whether they were built after St Elmo’s mill became dilapidated thus hastening the necessity to demolish it. What can be ascertained is that when the fort underwent the construction of a new enceinte and a new ring of ramparts in 1687, this windmill was no longer part of its precincts.

Nicholas Cotoner is credited with building 15 windmills in Malta, two of which on St Michael’s bastion in Valletta. Another four windmills were built within the limits of the other harbour cities. Two new windmills were built in Floriana; the first one was in the area of Sarria church, exactly where there is now St Francis Street and Sarria Street. The second one was built on the other side of this suburb where today there is Robert

21 Clifford Vella, L-Imtiehen tat-thin tal-Qamh fil-Ġzejjer Maltin (Malta, 2011), 92.
22 Ibid, 95.
23 Stephen C. Spiteri, Fortresses of the Knights (Malta, 2001), 261. The windmill does not feature in Spiteri’s drawing of this fort.
Samut Square, close to the Capuchin convent. These windmills could have easily had a dual function.

It has been argued that these two windmills were built for grinding grain but one needs to remember that the nearby silos were built many centuries later when Richard More O’Farrell (1847-51) was governor of Malta. At the time of the knights, the silos in Floriana were mostly situated on the other side of the town, where the Capuchin convent is situated. Although one could counter argue that the windmill, built next to this convent, was intended to serve these silos, which were constructed during the reign of Grand Master Antoine De Redin (1657-60), one must not forget the position of these windmills within the fortifications system. Silos existed in front of Fort St Elmo as early as the late seventeenth century but the windmill within the fort, is specifically indicated in the above-mentioned maps of Valletta for the sole purpose of manufacturing gunpowder. Furthermore, both these windmills were built next to lines of fortification and, in the case of the one near the Capuchin convent, close to a powder storage magazine, which is a strong indication as to the intended purpose of this mill. Moreover, a few metres away from the windmill situated next to Sarria church was ‘La fabrica della polvere’ or the magazine where gunpowder was produced. Sebastiano Ittar highlights the presence of this gunpowder factory in his map of Valletta and its environs which he made towards the end of the eighteenth century.

In 1674, the same year when the two windmills were built on St Michael bastion, two new windmills were constructed at Cospicua: the Cotoner Foundation built the two tower windmills on St Margherita’s hill, overlooking the Firenzuola bastion. The next grand master, Gregorio Caraffa de Roccella (1680-90), created his own foundation for the construction of windmills. Ten new windmills were built during his reign, one of which was again at Bormla, this time, in the area of San Ġwann t’Ghuxa. Unfortunately, there is not much information available about these windmills. One cannot exclude that, after the explosion of the powder house in Birgu in 1806, these windmills in Cospicua were

24 Caruana, 47.
25 C. Vella, 10.
26 Ibid.
27 Bibliothèque Nationale de Paris, 8459 GeC 1354. I would like to thank Dr Gianni Scaglione for pointing out this map to me.
28 Caruana, 47; C. Vella, 35–6.
29 Caruana, 49.
converted or cleaned and began to be used for grinding wheat. The Santa Margherita ones began to be used for the grinding of corn in the nineteenth century when the new colonial power in Malta leased them to Carmelo Bonavia, who hailed from a family of millers from Naxxar. These windmills were given to him in emphyteusis for 100 years.30

That these Bormla windmills, in particular those built in the area of Santa Margherita, were used for gunpowder production cannot be disputed. Their position, at the edge of bastions, overlooking the countryside and not far away from the gunpowder magazines of Birgu, helps one to immediately dismiss any other theory regarding any other use. In fact, about a hundred metres away from them, at the entrance to Birgu, there was the *Polverista*, which blew up in 1806. One can argue that these two windmills were built to serve the needs of the peasants of nearby Żabbar which had no windmill until the nineteenth century.31 Therefore, peasants in this area would either make use of the windmills in Cospicua or those in Żejtun. Yet, while one can argue in favour of an interchanging use of these windmills, collateral evidence indicates that these windmills in Cospicua were used for the production of gunpowder.

One could debate that these windmills were being built within the city walls because of the fear of a siege. But, in case of siege, the cities would have closed their gates and no farmer could have been able to bring his grain into the city. Besides, these windmills would become easy target for the enemy’s heavy guns. Above all, the cities stored wheat as grain or even as flour but never with attached hulls or fruit layers. There was also the windmill at San Ġwann T’Għuxa which too lay on the edge of the bastion walls. Although one can argue that it was constructed to suit the needs of the peasants who had their fields in the area now comprising Fgura, Blandun Valley, or Ghajn Dwieli, one can also confirm that this too was built for gunpowder purposes. In fact, the street adjacent to the windmill is still known as *Polverista*, in direct reference to the gunpowder warehouse.

All in all, the position of these windmills fits perfectly well the description given by Dal Pozzo. These gunpowder mills were built in determined places along the fortification walls, near the gunpowder stores. The three windmills in Cospicua were close to an open space in the fortification walls. Therefore, there should be no doubt that the windmills

30 I owe this information to Mr Karm Bonavia who is one of his direct descendents
31 Clifford Vella, 221. which Vella?
in Bormla were for gunpowder production and the open space next to them was used to store cannon balls and ammunition. Unlike Floriana, Bormla’s windmills did not have any silos next to them. Surviving plans for the two windmills built in the Santa Margherita area show an edifice comprising 12 rooms together with the later addition of a furnace with its chimney. The date of the construction of this furnace is not known but it survived the test of time as described by Clifford Vella in his book on the windmills.

The production of charcoal powder

In describing the interior of a gunpowder mill, the maritime historian Alberto P. Guglielmotti goes into the details of its mechanism but, from the description given, it seems to have been no different to the one used for grinding grain since both windmills worked on the same principle, the only addition being the presence of a furnace:

Gunpowder Mill: a large building where, due to the strength of running water, machine wheels turned and pistons are deployed for the crushing and grinding of a mixture of components; the furnace and the coal warehouse, the refinery and the saltpetre boilers, the alembic and the tubs for sulphur, bowls, large pestles, utensils for pounding, a kneading-trough for the paste, planking for drying the mix, sifting machines, tubs, basins, burnishers, large ladles, razieres, sieves, jars, barrels and cartouches.

This description refers particularly to the powder mills in Northern Italy and Northern Europe where gunpowder production made use of their countries’ rich water resources. On this side of the Mediterranean, including Malta, grinding wheels were turned by wind power. In Malta,

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33 C. Vella, 38.
34 Alberto P. Guglielmotti, Vocabulario della Marina e del Militare (Rome, 1889), Sub voce polvere. Mulino di polvere, edificio grande dove per forza di acqua corrente si nuovono macchine ruote e pestoni alla triturazione miscela dei componenti. D’accanto la fornace ed il magazzino del carbone; la raffineria e le caldaie del nitro, il lambico, e le vasce del solfo. Poi ciotole, pestoni, e batterie per la triturazione, madia per la pasta, tavole di prosciugamento, frulloni per granulare e per brunitre tramogge volande, tinozze, tazze, bruiogli, mestelli, raziere, stacchi, giarre, barriglioni e cartocci.
gunpowder was obtained by having a pair of large lime stones turning against each other in a threshing motion. The presence of a furnace, which can be dated with certainty to the time of the knights, is another proof that the production of charcoal took place within the mill. In mills which lacked a furnace, the wood was piled in a manner to form a cone, covered with mud or other material, and set alight. The combustion had to be continuously kept under control.

Malta did not have the natural resources to produce gunpowder, except for charcoal which was obtained mostly from vine wood or through imported wood. This tradition of charcoal production from vine stems was (and perhaps is still) in use in Malta in connection with the local tradition of fireworks manufacturing. Overall, the use of vine stems to produce charcoal requires a historical reflection and one may ask if there is any connection between the toponym Ghajn Dwieli and the production of charcoal at one of the furnaces of the windmills of the harbour cities. No doubt the name Ghajn Dwieli is derived from the fact that there were vineyards in this locality. According to Godfrey Wettinger, the oldest reference to this toponym apparently was made by Gian Francesco Abela in his book published in 1647.\textsuperscript{35} In a later document dated 1649, it is referred to as a ‘\textit{contrada}’.\textsuperscript{36} The place-name does not seem to appear in surviving pre-1530 documents.

One just wonders if there is a correlation between the presence of such vineyards and the gunpowder windmills built first at Senglea and then at Bormla in early modern times. Is it a feasible conjecture that vines began to be cultivated in this area as a result of the presence of specialized gunpowder windmills at Senglea and Birgu? No doubt the presence of these windmills generated an added-value in Malta for the cultivation of vines. Incidentally, the two types of Maltese grapes, i.e. Girgentina and Ġellewza, are not amongst the best to produce wine but their vine-stems could have been among the best to manufacture charcoal. If this is the case, then the story of the introduction of these types of grapes in Malta should be linked to gunpowder production rather than the drinking of wine.

Above all, is there a correlation between the use of deciduous vines and

\textsuperscript{35} Godfrey Wettinger, \textit{Place-Names of the Maltese Islands, ca. 1300–1800} (Malta, 2000), 182.
\textsuperscript{36} NLM, AOM 472, f. 472.
One of the two windmills at st Michael’s Bastion in Valletta with the presence of ammunition piled in its precincts.

Sebastiano Ittar’s map highlighting the gunpowder factory at Floriana. (Bibliotheque Nationale de Paris)
the slow development of the art of gunpowder technique in the Ottoman Empire? The Ottoman Empire lagged behind in the use of gunpowder weapons. One explanation for this was the lack of raw materials to make firearms, but such shortage was a characteristic of all Mediterranean countries. The Ottoman army sought to adhere – as long as technology permitted – to the use of crossbows by their warriors, the Janissaries, even after such weapons ceased to be utilized in the West. Was this due to the lack of sufficient vine stems for the production of gunpowder charcoal? It is a fact that vineyards were not among the favourite agricultural product in the Ottoman Empire due to the association of grapes with wine production. For religious reasons, the cultivation of vineyards was discouraged throughout the empire. Could this lack of sufficient vines affect the production of gunpowder charcoal and the development of military technology within the empire? Whatever the case, during the seventeenth century, the knights considered Turkish gunpowder to be of extremely bad quality. The Knight Hospitaller Gio. Maria Caravita passed the following comment when he discussed regulations concerning the keeping of gunpowder in his Second Treatise on the Common Treasure: ‘Turkish gunpowder is always poorly processed and always needs to be refined in order to work effectively.’

However, Malta too underwent its specific endogenous developments in the production of gunpowder. Gentilini does not specify any tree for the production of charcoal powder but talks generically about the use of wood, without qualifying the type, due to the fact that resources in Northern and Central Europe differed from those in the Mediterranean. At the same time, he explains that certain types of wood, once pounded, yield a sort of ‘white powder’. In the seventeenth century, the North was already using mines to extract mineral resources with the result that countries like Malta could not be self-sufficient in gunpowder production but had to depend on the importation of at least two other chemicals to mix it with the locally produced charcoal to obtain the correct blend.

Manuscript 318 at the National Library of Malta gives a detailed account on the production of gunpowder as well as the mathematical correlations of how gunpowder was being mixed in Malta. Each concoction

37 Private Collection, ‘Trattato Secondo del Commun Tesoro Composto dal Fù Illustissimo Signor Prior Caravita’, 490, ‘nota che la polvere Torchesc si trova sempre mal lavorata e però ha bisogno d’acconcio per potersene utilmente servire’.
38 Eugenio da Gentilini, Pratica di Artiglieria (Venice, 1641), 67.
depended on the master-in-charge of the blend because, in truth, while the basic ingredients remained the same in each country, each master had his own method on how to mix the gunpowder. The gunpowder consisted of three main ingredients: saltpetre, sulphur, and charcoal powder. The author goes into detail and gives the mathematical formulas for the production of gunpowder which in his case are based on the use of 75 pounds of saltpetre which was added either to 12 or 18 pounds or half-pound of sulphur. The selection of a particular formula depended on the use to be made of the gunpowder. The same type of mixture was used in relation to charcoal. This was also divided into measurements of 12 or 18 pounds or a half a pound with every 75 pounds of saltpetre. These were proportional measurements used to produce different kinds of gunpowder to suit the different calibre of weapons. Everything was blended thoroughly until a single composition was obtained. The number of times that the resulting paste, also known in technical military jargon as ‘meal’, had to be ground depended on the experience of the master in question, who beat the mixture for four hours. Others did it for 30 hours and some even for 36 hours. After the mixture had solidified, it was left to dry. It was then pounded into small particles and passed through a sieve, so that the particles were carefully separated and selected according to thickness.39

Gunpowder was ranked in terms of ‘asseti’, i.e. according to the proportion of charcoal used (assets) in relation to saltpetre and sulphur.40 Above all, gunpowder could also be affected by the elements of nature. Humidity played its part. Gunpowder used on French warships contained more saltpetre. A higher amount of saltpetre was added to compensate for the humidity generated by the sea spray.41 On the other hand, France did not have different mixes of gunpowder for cannon and muskets. The mixture was always the same.42

For this reason, the author of this anonymous manuscript writes that ‘one needs to know that in the use of artillery, both at sea as well as on land, there are three types of charge: one for trials, one for salute (salvo), which is the same as that used on land for shelling one point, and [thirdly]

40 Gentilini, 7.
41 Edits Declarations Reglemens et Ordonnaces du Roy sur le fait de la Marine (Paris, 1675), 106.
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that used in battle which is lesser than the other two. The reason for not loading the cannon at sea with the same amount of gunpowder as those on land is because sea battles last longer and are more violent that those on land …’ The author continues to state that ‘gunpowder is the soul of the artillery because without powder, cannon, mortars, and other guns would be useless.’

To be of superior quality, gunpowder had to be purified. There were many ways of obtaining this. One method was to purify it with saltpetre which worked as an oxidizer. Another was to purify the charcoal powder using wood ash. Others preferred to use alcohol to purify gunpowder. This latter appears to be the most popular method as can be deduced from the presence of the distillers used for making aquavit at the mills. It reduced the dust in the air and diminished the risk of explosion. Guglielmotti was in favour of this last method. Some manuals suggested the use of brandy, which was none other than aquavit.

In either case, the gunpowder would be sprayed with brandy or with aquavit and folded into the mixture. Once added, a simple test was made to check whether the quality of gunpowder had improved or not: a little bit of gunpowder was placed on the tip of the finger and set alight. If one did not feel the burn against the skin, this meant that the gunpowder was good. Another liquid used to purify the saltpetre was urine. Probably this was used in absence of alcohol since urine contains ammonia. The need to purify the mix derived from the fact that the impurities in the saltpetre made it prone to humidity, a factor that prevented the gunpowder from working properly. Malta was no exception for sulphur too went through a refining process. The knights built a specific warehouse to store the various instruments for purifying it.

Ibid., 187. Si deve sapere che nell’artiglieria tanto di mare che di terra, vi sono tre sorti di carica, cioè la carica per la prova, quella pel saluto, che é la stessa in terra per battere in Breccia e quella pel combattimento, che é minore delle due precedente: La ragione perché non si da la stessa quantità di polvere ai cannoni in mare, come a quei di terra, é perché i combattimenti di mare sono più lunghi e più violenti delle battalgie di terra... The author continue to state that ‘La polvere’... is ‘l’anima di tutta l’artiglieria perché senza la polvere, i cannoni, i mortari ed altre bocche di fuoco non servirebbono a niente.’.


Ibid. 254.

Ibid., 160.

Ibid... 

Ibid., 154.

Trattato Secondo del Commun Tesoro, 488.
By the eighteenth century, the system had greatly progressed leading to the grading of gunpowder into three different categories.\textsuperscript{50} Above all, the entire production, including the purification process, took place inside the mills thus turning those used for the production of gunpowder into veritable fireworks factories.

Malta did not have saltpetre or sulphur which had to be imported. The Ship Arrival Records (also known as booklets) at the National Archives of Santo Spirito at Rabat are a source of information about the importation of these products. For example, in 1746 these registers record the importation of 800 tons of sulphur brought over on a ship of the Martengana typology.\textsuperscript{51}

Above all these products, like all the other products related to gunpowder production, fell under State monopoly. The fact that windmills in Malta were State-owned could have reflected the fear that these structures could be used in gunpowder production besides the milling of wheat. In fact, it was only during the British period that all restrictions on building windmills, which existed from the times of the knights, were lifted.\textsuperscript{52} Moreover, as in other countries, the production of gunpowder was heavily regulated.\textsuperscript{53} Possessing saltpetre, sulphur, and even the use of charcoal was prohibited. Similar measurements existed in Sicily with the result that such monopolies brought about a contraband trade. One particular document records the involvement of Maltese seamen in smuggling the crushed paste and saltpetre into Sicily.\textsuperscript{54} In this particular court case, the paste was referred to by the Italian word ‘\textit{la scagliata}’ in direct reference to how this powder had been crushed after it had been ground against large rotating circular flint stones.

\textbf{Conclusion}

The production of gunpowder had to take place within the precincts of cities, not only to be under the direct supervision of the authorities but

\textsuperscript{51} N\[ational\] A\[archives\] M\[alta\] (Rabat), Libretto No. 101, dated 24–6–1746.
\textsuperscript{52} Caruana, 66.
\textsuperscript{53} NAM (Rabat), Liber (Libretti or Arrival Booklets) 26, 21.
\textsuperscript{54} NAM (Rabat), Consolato del Mare, Vol. 14, Causa, Aloysio Petit versus Matteo Pace 1713, f. 13, item 5.
also because the cities consumed the highest amount of gunpowder. Large amounts of gunpowder were required, both for the land defence system and for the knights’ maritime activities. Even the local Universitas, a sort of town council, had to share the burden of providing black gunpowder for the defence of the coastal watch towers which began to be constructed all over the vulnerable points along the coast from the beginning of the seventeenth century. If one decides to dismiss this theory that windmills were also being used for gunpowder production, then one has to account for their presence within the harbour cities. While one could argue that gunpowder was produced through the use of other types of mills, such as the animal-driven ones, then one would have to explain why these were not considered State monopolies. For example, some private houses in Bormla still reveal tell-tale signs of the presence of animal-driven mills. There should be a consensus that the presence of such animal-driven mills in various Maltese houses was exclusively used for grinding wheat and barley. Therefore, in the absence of windmills used for the gunpowder production, one still has to account how and where

55 NLM, AOM 646, ff. 95–6.
gunpowder was produced in the time of the Order. It is unthinkable that part of the gunpowder used locally was not manufactured here in Malta.

At first the presence of these windmills could have created a perilous situation. Maybe, this was also another consideration, besides that of the wind, which explains why they were sited in open spaces on the bastions. Other Mediterranean cities had their own respective tragedies. Venice experienced the explosion of its Polverista in 1569. The island of Candia (Crete) suffered a similar experience in 1692 when 20 people got killed. In Malta, safety measures must have dramatically improved since no explosion was ever recorded during the eighteenth century in relation to the production of gunpowder.

One can therefore conclude with certainty that the knights started building windmills inside the city walls for military purposes and one would be drawing the correct conclusions in assuming that the windmills in Bormla and Floriana (if not all, at least some) served as centres to produce charcoal. There should be no doubt that those on St Michael bastion continued to be used for charcoal production as the old photograph clearly attests but its production must have declined heavily during the nineteenth century. The way the unique windmill of Bormla on St Margherita hill was constructed is undeniable proof that this complex was originally intended for the production of charcoal powder. It is a great irony that its grinding mechanism was removed from this mill in the 1970s and, according to one particular source, used for the restoration of the Xarolla windmill in Żurrieq which was purely intended for the grinding of wheat.

At any rate, of all the windmills built to serve the production of gunpowder, those of Bormla have survived in toto. Unfortunately, their current state of preservation leaves much to be desired and one would like to hope that this article spurs the authorities to take the initiative to restore them to their former glory. At the St Margherita mills there is an open space next to the windmills, which in the distant past may have been the depot for all sorts of cannon balls and other ammunition but is now occupied by garages and a Boċċi Club (Bowls Club). These two mills, on St Margherita’s hill in Bormla, are the only two remaining mills in Malta which were built next to each other thus confirming, once again, the rich and unique heritage of this city.

57 NLM, AOM 1771, f. 32v.
58 C. Vella, 38.