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8. A tale of two ridges: topography, connectivity and use at Borġ in-Nadur and Tas-Silġ

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Abstract. Marsaxlokk is one of the most sheltered harbours in the Maltese archipelago, and has been exploited since the earliest known settlement of the islands. The variability of the coastal and inland topography around the harbour presents constraints as well as opportunities, which have influenced human decisions and strategies in different periods. The two key sites of Borġ in-Nadur and Tas-Silġ are compared. GIS-based Cost Surface Analysis and Least Cost Path Analysis are used to explore the different types of connectivity enjoyed by these sites. It is argued that this difference is a hitherto undiscussed factor behind the different trajectories that these sites follow in different periods.

Keywords: Connectivity, landscape, GIS, Borġ in-Nadur, Tas-Silġ.

8.1. Introduction

Marsaxlokk is one of the most sheltered and inviting harbours in the Maltese archipelago. It has been exploited from the first known occupation of the islands in the Għar Dalam phase, named after the eponymous cave a short distance inland, down to the present day, when it hosts one of the largest container transhipment terminals in the Mediterranean. The variability of the coastal and inland topography around the bay presents constraints as well as opportunities,

which have influenced human decisions and strategies in different ways across the past seven millennia. This chapter focuses on two ridges near the bay that have both yielded a rich archaeological record of intensive use across different periods. The key archaeological sites on the two ridges are respectively Borġ in-Nadur and Tas-Silġ, both of which are positioned at locations that command interaction between land and sea. On closer scrutiny, significant differences may be observed between the connectivity enjoyed by the two locations at the local scale. The aims of this chapter are firstly to explore the role of connectivity in the selection of both these sites, secondly to characterise the different types of connectivity they enjoy, and third, to propose that this difference is an important factor in explaining the different life-histories of these sites across different periods.

The landscape context will be described in brief, and the different life-histories of Borġ in-Nadur and Tas-Silġ, as presently understood, will be outlined. The different types of connectivity enjoyed by the two locations are then explored using GIS-based Cost Surface Analysis and Least Cost Path Analysis. The different patterns of connectivity enjoyed by the two sites are then used to inform a better understanding of the different ways these two sites are exploited across time.

8.2. The landscape setting

Marsaxlokk Harbour lies at the south-eastern extremity of Malta, between the south-west coast that is formed by precipitous cliffs, and the low-lying, indented north-east coast that is characterised by bays and harbours. In the region under consideration, two of these deserve mention because they offer some degree of shelter to small vessels. St Thomas Bay lies less than two kilometres away from Marsaxlokk Bay as the crow flies, while the creek of Marsascala lies another kilometre further north. A saddle-backed ridge (one of the two ridges in this story) runs between Marsaxlokk to its south, and St Thomas Bay and Marsascala to its north. The two ends of the ‘saddle’ are San Girgor in Żejtun, and the Delimara peninsula. Tas-Silġ lies on a knoll that rises from the middle of the ridge’s ‘saddle’ (Figs 1.1, 2.1).

Within Marsaxlokk Harbour, two headlands known respectively as San Ġorg (a.k.a. il-Gżira) and San Luċjan divide the shoreline into three embayments, namely Birżebbuġa Bay, St George's Bay, and Marsaxlokk Bay. A separate valley system meets the sea in each of the three bays. The most deeply incised of these valley systems is the central one, composed of the two deep wadis of Wied Żembaq and Wied Dalam. The two wadis follow a generally parallel course down to St George's Bay, and are separated by the long and narrow ridge of Borġ in-Nadur, the other ridge in our story.

8.3. Convergences and divergences: two life-histories

Human exploitation of the Marsaxlokk Harbour region begins with the earliest known phase of human occupation of the Maltese archipelago. The cave-site of Għar Dalam, (incidentally the type-site for the first phase of the Maltese Neolithic) lies along Wied Dalam, about 700 m inland from the present shoreline.

The available evidence for Neolithic settlement in this region appears to follow a pattern that has been observed across the Maltese islands more generally. Around the middle of the fourth millennium BC, monumental buildings appear across the archipelago in locations enjoying access to three key resources; land suitable for agriculture, fresh water, and the sea[1]. The available evidence strongly suggests that these monumental buildings were raised in areas that had already been exploited for centuries prior to the emergence of monumental architecture, very probably as settlements. The Marsaxlokk Harbour region is marked by a concentration of Neolithic monumental sites that is evidently connected to the sheltered embarkation points afforded by the region's creeks and bays. The known megalithic buildings include Borġ in-Nadur, Tas-Silġ, Ħal Ġinwi and Xrobb l-Għaġin. This density of monumental activity may be read as a proxy indicator of intensive exploitation of the opportunities afforded by access to the sea and to the gently rolling terrain that characterise south-east Malta. This combination not only facilitated maritime connectivity and porterage within and beyond the archipelago, but

[1] Grima 2004.

also made it possible to complement the agricultural subsistence base with marine resources in times of crop failure.

The meager evidence available suggests that, from around the mid-fourth to the mid-third millennium BC, the sites of Borġ in-Nadur and of Tas-Silġ ran on a parallel course, both witnessing the construction of a megalithic building in a position that commanded routes of movement between the island's interior and sheltered embarkation points on the coast.

Following the drastic, and as yet poorly understood, changes that took place around the middle of the third millennium, conventionally taken to mark the end of the Maltese Neolithic and the beginning of the Bronze Age, both Borġ in-Nadur and Tas-Silġ appear to have remained in use. Both sites have yielded evidence of continued use through the Tarxien Cemetery phase and the Borġ in-Nadur phase[2]. The evidence suggests that, by the Borġ in-Nadur phase, the life-histories of the two sites, which had hitherto run on very similar lines, had finally begun to diverge. While ceramic counts from Tas-Silġ[3] indicate that the site was intensively used in this phase, the evidence from Borġ in-Nadur itself suggests activity on an altogether grander scale. The extremity of the ridge that is flanked by Wied Dalam to the north-east, Wied Żembaq to the south-west, and St George's Bay to the south-east, appears to have undergone a new phase of monumental elaboration. The extremity of the ridge, already sharply defined by the deeply-incised wadis, appears to have been marked off from the rest of the ridge further inland by massive walls built across the width of the ridge from Wied Żembaq to Wied Dalam. Recent re-evaluation of the material from successive excavations on this site[4] is suggesting a bustling entrepot that maintained contacts with a much wider world, in ways that were barely conceivable in the Neolithic.

The transformation of the Mediterranean world during the classical period resulted in a renewed reconfiguration of the cultural landscape around Marsaxlokk Harbour, which also represented a reversal of fortunes in the life-histories of Borġ in-Nadur and Tas-Silġ. The importance of Borġ in-Nadur itself appears to decline

2 Cazzella, Pace and Recchia 2007.
3 Cazzella and Moscoloni 2008.
4 Tanasi 2008: 7-22; Tanasi, this volume (chapter 4).

dramatically, although a new type of activity emerges about 400 m further inland on the same ridge, at the site known as Ta' Kaċċatura. An agricultural establishment is created here possibly already during the Punic period[5], and persists in use through the Republican and early Imperial period[6]. Oil-pressing appears to have been a key activity here. The immediate environs of the site on a rocky ridge isolated on either side by a deep wadi appear at first to be an unlikely position for a *villa rustica*. The foremost purpose of such a complex is to transform agricultural produce, in this case the olive crop, into an easily transportable bulk commodity, in this case olive oil packaged in amphorae. Connectivity is therefore a key consideration in the location of such sites. Studies of Roman villas in central Italy, for instance, have identified access to a good transportation infrastructure as one of the key elements determining their location[7], while a pioneering study of the distribution of villa sites in Malta has shown that most of the recorded villas lie within two or three kilometres of the sea[8]. On closer examination of the location of Ta' Kaċċatura, it appears clear that the positioning of the villa is closely tied to the route formed by the ridge itself between the fertile interior and Marsaxlokk Harbour. It is effectively located along the most efficient route between the gently rolling and fertile terrain around Għaxaq and Gudja, and the sheltered anchorage formed by St George's Bay. The villa is in fact precisely positioned at the point where the narrow ridge between Wied Żembaq and Wied Dalam broadens out from a narrow, windswept and rocky spur to a broader and flatter fan that stretches on towards Għaxaq and Gudja, much more suitable for the retention of a good soil cover. The dictates of transport of bulk commodities are precise and unforgiving, all the more so where transport by land is concerned. The villa is positioned at the optimal point of convergence for the harvest from the territory further inland to be gathered in, to be transformed into a preserved commodity which was more easily transportable and ready for shipping. The onward journey of amphora-borne oil to St George's Bay would not have

5 The evidence for a Punic origin of this villa is very tenuous (Vella 2010: 74-75).
6 Ashby and Rushforth 1915.
7 Marzano 2007: 154.
8 Bonanno 1977: 75.

required any 'doubling-back' on the transportation of the crop to the villa, making the whole a seamless optimisation in terms of expenditure of effort by slaves, workers and beasts of burden alike.

At Tas-Silġ, meanwhile, a new and vibrant chapter was unfolding. The ruins of the Neolithic monumental complex are reorganised into the heart of a new sanctuary complex, perhaps the most sophisticated on Punic Malta, and certainly the best documented. In the Republican period, the complex continues to be enlarged and embellished, and its fame even found its way into Cicero's Verrine Orations, where he sings its praises as an ancient and venerable sanctuary revered by mariners from far and wide, regardless of race or politics[9].

Further inland on the same ridge, another *villa rustica* broadly contemporary[10] with that at Ta' Kaċċatura was established at San Girgor, very near the eponymous late medieval parish church of Żejtun, on the south-east edge of the present-day town[11]. The same logistic considerations observed at Ta' Kaċċatura may be noted here, responding to a different set of constraints and opportunities. The possibility of access to different embarkation points presented an opportunity not available on the Borġ in-Nadur ridge. The Żejtun villa is positioned very near the point of divergence in the present-day road network between the road to St Thomas Bay and Marsascala, and that leading down to Marsaxlokk. The present-day road network in this district appears to have been largely formed by the early modern period, and parts of it may be much older. The positioning of the parish church of San Girgor here in the late Middle Ages appears to have been equally tied to the connectivity this point afforded with the districts serviced by the parish. Returning to the location of the villa, it may be observed that 350 m across fields due south of the villa, an extant road network descends through the tellingly-named Ras il-Wied (literally Head of the Valley) to Marsaxlokk Bay. This route may represent the least-cost path from the district of Żejtun down to the bay. On the other hand, the present-day road that runs from San Girgor along the spine of

9 Bruno 2004: 103-104.

10 Firm evidence of a Punic origin has been found at the Żejtun villa (Vella 2010: 462).

11 Other villa sites may exist in the vicinity of Marsaxlokk and St Thomas Bay (Bonanno 1977: 73-76). The present study has been confined to the more clearly attested villa sites at Ta' Kaċċatura and Żejtun.

the saddlebacked ridge, climbing again to surmount the knoll of Tas-Silġ before descending to Marsaxlokk, does not represent the most efficient route for the transportation of bulk commodities from the interior around Żejtun to the bay, and may have been shaped by other considerations.

In order to examine the above observations and hypotheses more rigorously, GIS-based tools were applied, using the methods that will be described next.

8.4. Characterising connectivity: methodology

Geographic Information Systems, or GIS, is a computerised system capable of storing, managing and analysing large amounts of spatial data. Not surprisingly, it has been most often used in archaeology for regional-scale applications focusing on the study of landscape (such as site prediction models, cost-surface and line-of-sight estimation, the identification of anomalies or distinctive patterns in data and virtual world applications) and therefore studies which would (or could) not commonly be carried out manually and this is no exception[12]. In order to better examine the influence of connectivity on the diverging life-histories of the two sites, bringing into the equation the terrain and the, primarily physical, impact it would have had on these connections, two complementary GIS studies were carried out. The first is Cost Surface Analysis (CSA), which is used to estimate the friction or cost of moving across each cell in the digital representation of a surface. In archaeology, this analysis is used to represent the concept of moving within a landscape, taking into consideration the effect that variables such as topography have on the effort (cost) required to do so[13]. As its name implies, the Least Cost Path Analysis (LCP) is a complementary study which uses the 'Cost Surface' to identify the most cost-effective path to go from one point (the source) to another (the destination), thereby verifying and characterising the different types of connectivity afforded by the configuration of the landscape in the Marsaxlokk region.

12 Bevan and Conolly 2004; Harris 2002; Llobera 2001.
13 Van Leusen 2002: 6-1; Wheatley and Gillings 2002: 151-157.

At the base of any such analysis are the data representing the landscape, which very often consist of a Digital Elevation Model (DEM) or a Digital Terrain Model (DTM)[14] as well as the algorithms and parameters utilised in its processing. These elements determine both the resolution at which analysis can be carried out, as it is limited by the size of the cells which make up the digital surface, as well as the quality of the results achieved[15]. In this case, the digital surface used was a DEM generated using stereoscopic aerial imagery acquired in May 2001, with a resolution of 10 m. Whilst the resolution is relatively high for such a study[16], the effect of built areas on the representation of the terrain is a serious drawback and introduces error into the data and subsequent results. This is however mitigated by the fact that built areas are clearly visible and that their effect on the results can be quantified and factored into the interpretation. The same cannot be said for the uncertainty or doubt introduced, for instance, by inconsistencies or errors generated during the creation of the DEM[17], by the fact that a single elevation value represents an area of 100 sq. m or by the fact that data acquired in 2001 are being used to create inferences on the landscape for a period of 3000 years or more starting in 3600 BC. Unlike error, uncertainty is an intrinsic and unavoidable property of knowledge and its influence on the final result cannot be clearly quantified[18]. Without the ability to identify and map accurately environmental changes in the landscape such as the rise in sea-level, tectonic movement, aridisation, sedimentation or human-made changes such as the impact of agricultural activity or field terracing which may have taken place since the beginning of the Neolithic period in Malta, it is not possible to quantify the level of

14 Digital Elevation Models and Digital Terrain Models consist of a regularly spaced grid of elevation values tied to geographic coordinates. A DEM contains unmodified elevation values which reflect whatever is on the ground and therefore includes the height of buildings, roads and bridges along with the terrain. A DTM, on the other hand, has been modified to contain nothing but the elevation of the terrain itself. The DEM utilised in this study was created by Datatrak in 2007.

15 Wheatley and Gillings 2002: 158-9.

16 The resolution of a DEM indicates the area represented by a single elevation value. In a 10-m DEM, one value represents a square area measuring 10 m by 10 m.

17 Parmegiani and Poscolieri 2003.

18 Couclelis 2003.

error being introduced into the study simply from the DEM[19]. However, since these problems are mainly perceivable at small scales, they do not detract substantially from the value and utility of the cost surfaces produced.

The analysis for this study was carried out using Global Mapper 12 for the initial processing of the DEM into a raster (grid) surface, followed by ArcGIS 9.2 with Spatial Analyst extension for the CSA and LCP analysis. The latter were carried out using Spatial Analyst's set of tailored tools for the processing of cell-based raster data, primarily the Cost-based Distance, Direction and Allocation as well as the Shortest Path tools. Although it is common practice to use an interpolation algorithm on a DEM to soften the abrupt change in elevation between adjacent raster cells (an effect of the resolution of the surface) by averaging the values and creating a more natural-looking surface, it was decided that for the scope of this study interpolation would not be used for two reasons. The first is that it would avoid the introduction of additional uncertainty into the results caused by the inability to quantify the degree of 'smoothening' of each cell in the surface. The second is that, without additional data necessary to exclude built areas, interpolation would have created dense, strangely-shaped hilly areas where modern towns are located. The cost of the decision is that the surface retains the abrupt changes in elevation between cells creating an artificial 'staircase' effect but this was deemed to have a lower impact on the analysis than the interpolation.

The extent of the study area was set to include only the southern half of Malta and the DEM was therefore clipped using an arbitrary line bisecting the island in a NE/SW direction, from Valletta to Siġġiewi. A number of cells, mainly concentrated in the Grand Harbour area and in the definition of Marsascala bay, with anomalous values in the DEM, very probably acquired during the automated acquisition process from aerial imagery, were identified and converted to No Data values. Their small number and location means that it does not significantly affect the result.

[19] Campana 2009: 4; Shakleton, van Andel and Runnels 1984; Grima 2008.

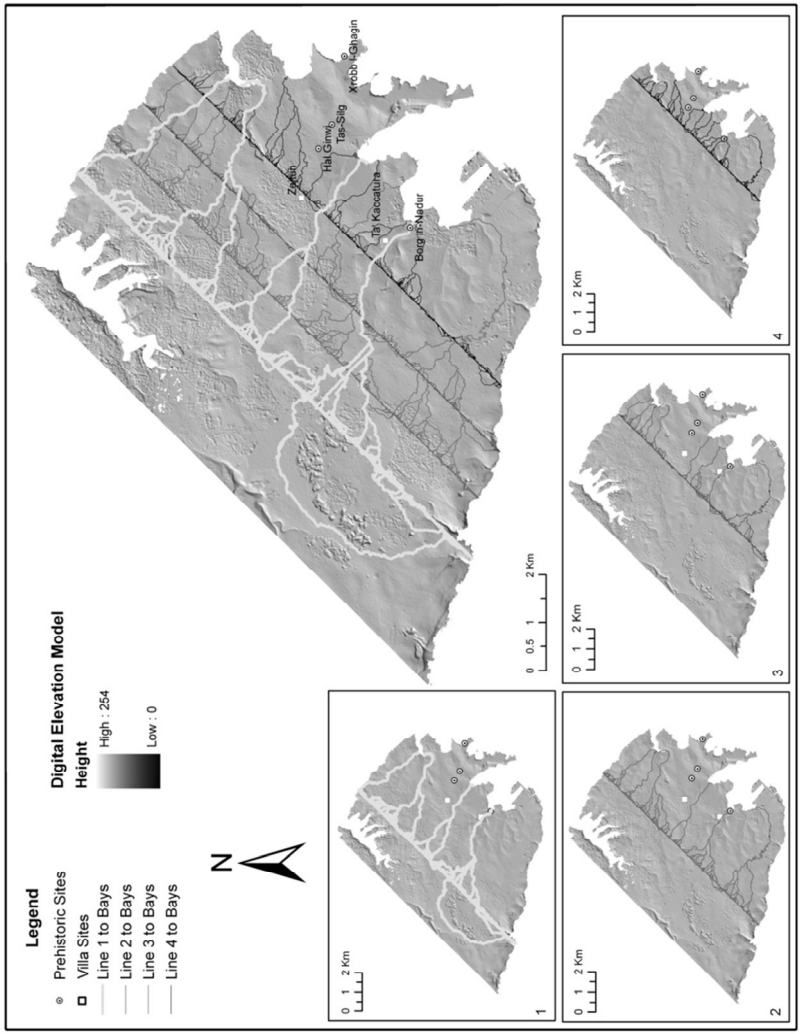

Figure 8.1. Least Cost Path: Line features show the most cost-effective routes leaving from each of the inland lines to reach only one of the five bays.

Apart from the DEM, the application of CSA requires two more elements: the choice of the source – the point/line/area for which

the cost surface is being calculated; and the choice of which properties of the terrain to factor into the cost of moving across it. The choice of point/s of origin for this area was based on the need to assess the connectivity in terms of access to the sea from the hinterland around Marsaxlokk Harbour, and vice versa. Therefore two sets of data were created. The points of access to the sea are represented by line features outlining the stretch of beach or easy access at the innermost end of each of the five main bays of south-east Malta, that is, Pretty Bay, St George's Bay, Marsaxlokk Bay, St Thomas's Bay and Marsascala Bay. Representing land was a more complex issue since practically any spot could be considered a source or a destination. As a representative sample, four parallel lines (placed one kilometre apart and cutting across Malta from one coastline to the other in a NE-SW direction) were created. In CSA each line is automatically rasterised into a series of cells, each of which is then considered a possible source during the analysis. Although the location of the lines was arbitrary, the length of the lines and the spacing between them provided enough coverage to be sufficiently representative of the area for the scope of this study.

The second element, the choice and number of properties of the terrain which affect cost, obviously depended on the nature of the area and of the study as GIS enables the computation of a cumulative cost surface which takes into account more than one factor. In assessing the connectivity between land and sea in this area, the three elements identified as the main contributing factors were distance from the source, slope gradient (since higher slopes are more difficult to traverse than a flat surface) and slope direction (since the cost of moving up a slope is higher than that of moving across the same slope). Using ArcGIS Spatial Analyst's custom tools, a surface representing the degree of slope over the land was created along with a second raster surface indicating the direction of the slope. These were then combined, along with distance from source, to create a cost-weighted surface. The end result is the Cost Surface, that is, the degree of cost or effort required to move across each cell. The application of CSA to the region was first carried out taking the bays as the starting point or source. The first step was therefore to compute a surface estimating the cost required to reach a point of

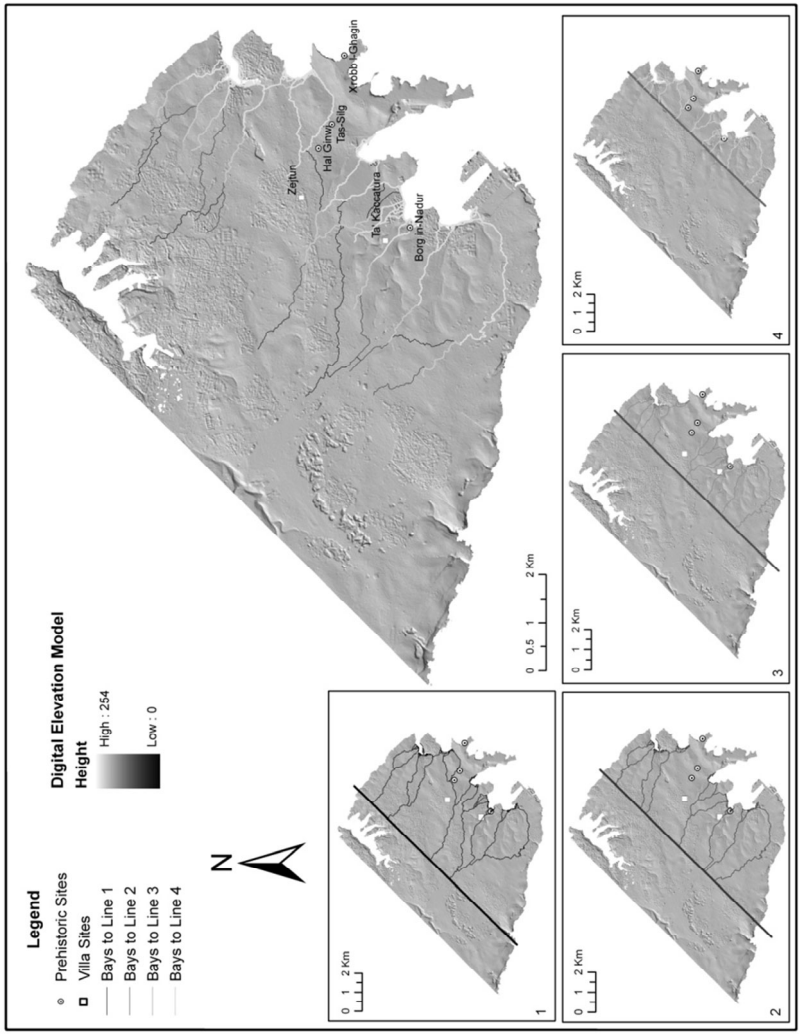

Figure 8.2. Least Cost Path: Line features show the most cost-effective routes leaving from each of the bays to reach a single point on each of the inland lines.

access to the sea from an inland location. The second was to consider the opposite route, creating a cost surface describing the journey which moved inland from any one of the bays.

The cost surfaces produced then became data to be used in the calculation of the LCP using ArcGIS's Shortest Path Tool. The name 'Shortest Path' is in fact misleading as the algorithm identifies the best route to take in terms of the data which have been input, that is, distance, slope and direction and the best route is not always the shortest. With further research on the level of effort required to move in a landscape using different modes of transportation available in different time periods – feet, sledge or carts are some of the possibilities – it would be possible to modify the parameters of the analysis accordingly and thus take a step further in assessing the validity of the Least Cost Paths obtained[20].

The end result is the definition of paths, in the shape of line features, travelling across the landscape. An important limitation of the present analysis is that the DEM used included artificial modifications to the landscape such as buildings, quarries and roads, which may alter the course taken by one of the computed paths towards or away from these features. Likewise, the discontinuous surface caused by the lack of interpolation creates an unnaturally jagged path. Examples of these effects can be clearly seen in Figs 8.1 and 8.2 where one path swerves sharply away from crossing the numerous quarries in the Mqabba area in order to reach a point of access to the sea while others circle around built areas to the north of Żejtun, possibly causing such paths to change course altogether. Another limitation, this time in the parameters set for analysis, is that for this study, only the five bays in or near Marsaxlokk were included as possible embarkation points. Other favourable embarkation points elsewhere along the coast, which have been taken into account elsewhere[21], were deliberately excluded from the present analysis, to focus on comparing the relative accessibility of these five bays.

Notwithstanding the limitations that have been outlined, the results of CSA and LCP analysis highlighted a number of interesting trends. Examining the location of the sites of Borġ in-Nadur, Tas-Silġ

[20] Van Leusen 2002.
[21] Grima 2004.

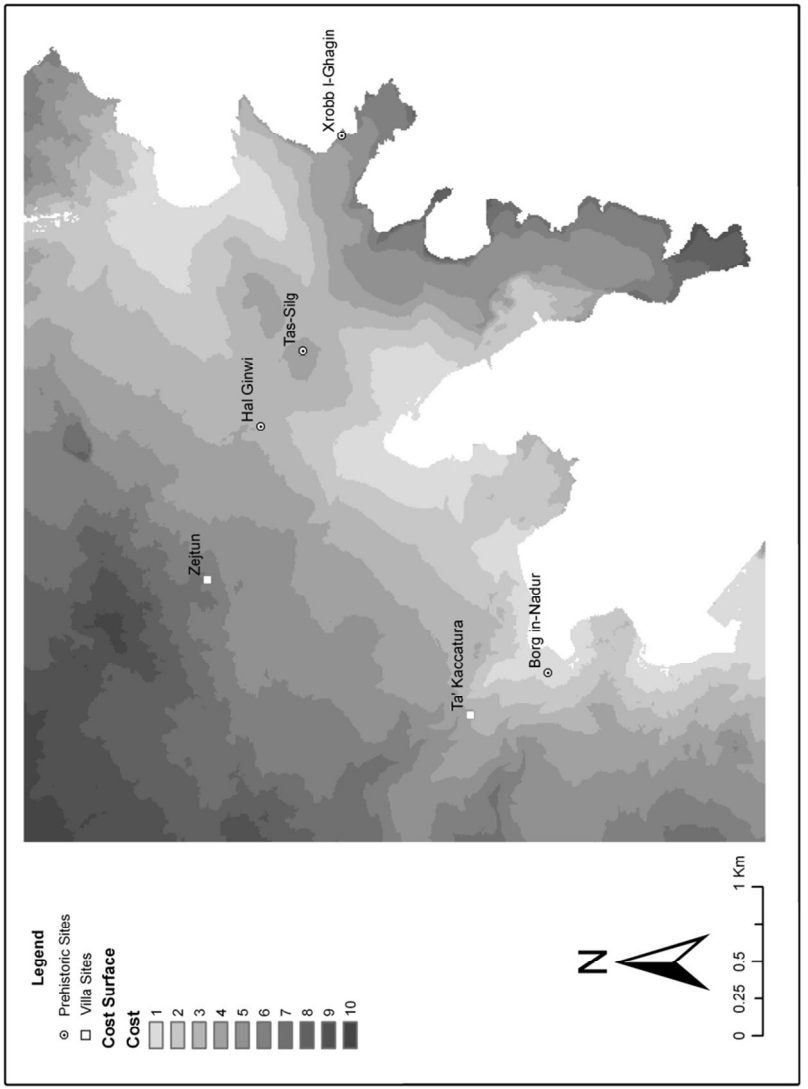

Figure 8.3. The Cost Surface of the area, reclassified into smaller cost bands, shows the difference in the cost required to reach any of the sites included in the study.

and other sites nearby, against the cost surface quantifying the cost of moving inland from the bays, it may be noted that the sites under consideration are placed at various cost-distances from the sea.

Among the prehistoric sites in the area, Borġ in-Nadur is the only one placed squarely in the lowest band of cost. Ħal Ġinwi is located on the border between the two lowest bands whilst Tas-Silġ and Xrobb l-Għaġin are in a higher band. Among the later sites, Ta' Kaċċatura is located close to the border between the two lowest bands while Tas-Silġ and Żejtun are in a higher cost band. Re-classifying the results into a higher number of cost bands, thereby reducing the range of values in each band, further accentuates this difference, particularly for Tas-Silġ, which is located in a cost band which is significantly higher than the surrounding area (Fig. 8.3).

Inspecting the different results of the Least Cost paths starting from each of the four inland source lines and moving towards the bay, it may be observed that the numerous routes starting from the lines progressively converge into a much smaller number of very specific routes, each of which ends at one of the five beaches (Fig. 8.1). The closer the source line is to the bays, the less convergence there is and therefore the greater variety of routes from different points of origin along the source line. It is interesting to note the differences which the distance from the bays makes to paths such as the concentration in three of the beaches (St. George's Bay, Marsaxlokk Bay and Marsascala Bay) of the paths originating from the furthest line. Additionally, the individual beaches seem to be attracting pathways originating from areas which differ greatly in size. A simple test using ArcGIS's Cost Allocation tool (which divided the cost surface into zones according to each cell's preferred bay), was carried out to verify and illustrate this, creating a division of the area which closely resembles that indicated by the paths (Fig. 8.4). Repeating the analysis to identify least-cost paths leading inland from the bays produced a new set of paths which did not always follow the same route as the previous ones, reflecting the different challenges which the topography presents when moving in the opposite direction (Fig. 8.2). The results of the analysis will now be considered in terms of what it may reveal about connectivity and its influence on the evolution of the sites under study.

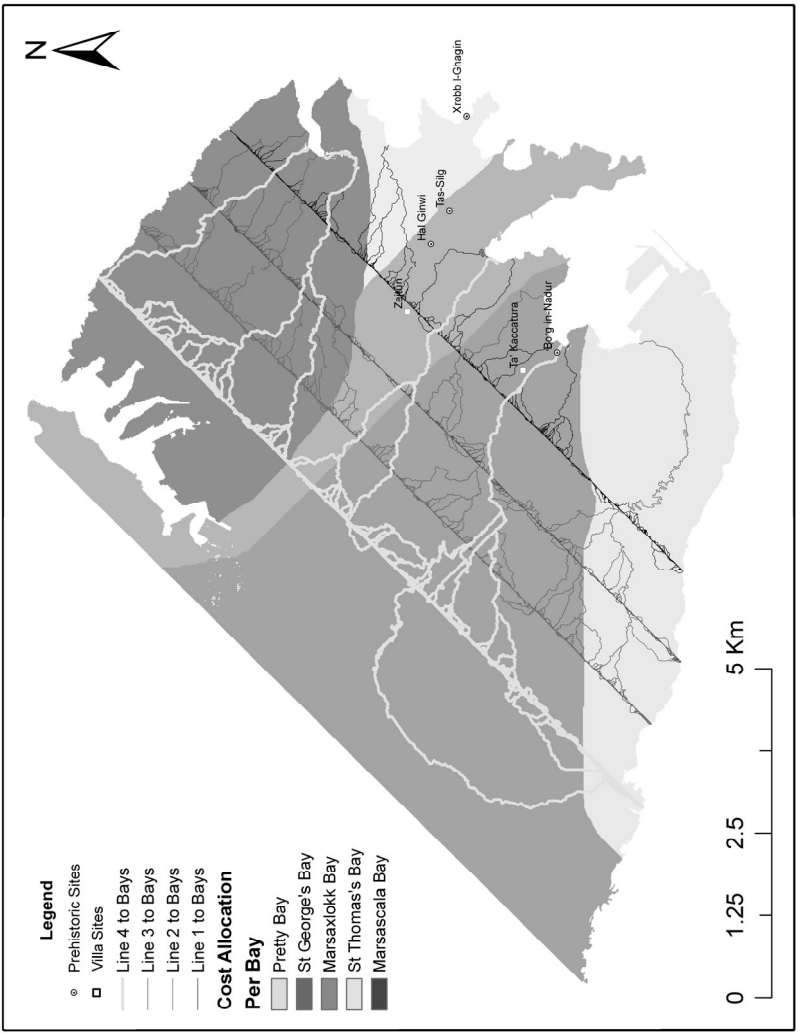

Figure 8.4. Cost Allocation Analysis: The division of the cost surface into zones according to the each cell's preferred bay.

8.7. Discussion

The question why the specific site of Tas-Silġ is chosen for such an important ritual centre in the Punic and Roman world has often been posed, but satisfactory explanations have proved elusive. The commanding position overlooking Marsaxlokk Harbour, as well as the coast further north, is cited as one important factor[22], while the presence of the remains of prehistoric monumental structures, which become the core of the Punic and Roman sanctuary, may also have influenced the choice[23]. These two factors prompt a rephrasing of the question of 'why at Tas-Silġ?' to ask 'why not at Borġ in-Nadur?'[24], because the latter also commands, and is rather closer to, a safe anchorage, and is likewise the site of prehistoric monumental remains. The interpretation of the sixteenth-century scholar Jean Quintin's text to suggest that Borġ in-Nadur was the site of a temple of Melkart or Herakles does not appear tenable[25]. Why then, Tas-Silġ and not Borġ in-Nadur? In addition to the possible explanations that have already been put forward by others, here it is suggested that the specific configuration of the landscape at Borġ in-Nadur and at Tas-Silġ was different in important respects, which resulted in a connectivity topology that was intrinsically different. These differences acquired crucial significance in the classical period, when they result in a decisive divergence between the life-histories of the two sites.

The CSA and LCP analysis reported above sheds new light on the question. The pronounced convergence of least cost paths from a large swathe of the harbour's hinterland through the Borġ in-Nadur ridge (Fig. 8.1) dramatically demonstrates that the ridge represented an important artery of movement between the harbour and the interior. This is confirmed by the cost allocation diagram which also shows that, of the embayments in and around Marsaxlokk Harbour, St George's Bay was the least costly to reach from a large sector of the interior (Fig. 8. 4).

22 Churchill Semple 1927: 380; Cazzella and Recchia 2007: 68; Recchia 2008: 238.
23 Vella 1999; Cazzella and Recchia 2007: 69.
24 Cazzella and Recchia 2007: 68-69.
25 Bugeja, this volume, comprehensively reviews this antiquarian tradition.

Furthermore, Borġ in-Nadur commands the point where Wied Żembaq and Wied Dalam meet the shore. Effectively, the shoreline below Borġ in-Nadur is the natural point of convergence between the three territories demarcated by the two wadis, that is the land south of Wied Żembaq, that between the two wadis, and that north of Wied Dalam. Effectively then, Borġ in-Nadur commands the point of convergence between three terrestrial routes (five if one includes the wadi bottoms themselves, though interestingly, none of the multiple least cost paths generated run along these valley bottoms) linking three territories to the sea (Fig. 8.1). Direct movement between the three territories was hampered by the wadis that ran between them, making porterage of bulk commodities practically impossible across them. Borġ in-Nadur, then, is a significant node of connectivity in that it commands the point where three distinct and separate sectors of hinterland meet along the shore. In other words, multiple terrestrial routes converge here on a single outlet to the sea.

Turning now to consider Tas-Silġ, we find the opposite to be true. Strung out on a narrow peninsula, Tas-Silġ is connected to the interior of the island in essentially one direction only. On the other hand, it is connected to the sea in multiple directions, Marsascala and St Thomas Bay to the north, and Marsaxlokk Bay to the south. Tas-Silġ is effectively a point of convergence between three maritime routes and a single terrestrial route, in this respect, the inverse of Borġ in-Nadur.

At specific moments in the life-histories of these sites, this difference assumed crucial significance. During the Neolithic, the presently available evidence suggests the two sites follow parallel trajectories. The relatively limited scale of seafaring activity probably rendered the access to multiple embarkation points enjoyed at Tas-Silġ less significant in this period. Both sites appear to follow the prevailing model of monumental buildings positioned in areas most favourable for settlement, because of their access to terrestrial and marine resources. Having said that, it should also be noted that the megalithic buildings that we presently group together as ‘temples’ may in fact belong to distinct types that have not yet been recognised through the archaeological record, such as different

dedications[26]. In the case of Tas-Silġ, it has been noted by the excavators that the atypical feature of a central axis joining a doorway at either end of the building is also found at Ħaġar Qim[27]. In the context of the present discussion, this may be tied to the topographic position of the two sites. Both Ħaġar Qim and Tas-Silġ are located on the spine of a saddle-backed ridge near the coast, which commands views of the surrounding territory in almost every direction. The creation of monumental doorways facing different directions is closely tied to this fact, as the more typical location of such buildings on a hillside makes it difficult to have a monumental entrance facing uphill. It is tempting to contrast the layout and location of Ħaġar Qim and Tas-Silġ to that of Mnajdra and Borġ in-Nadur, which follow the more conventional plan and topographic positioning. However the discussion on the differentiation of different possible types of megalithic monuments is difficult to pursue further until more fresh evidence is forthcoming.

During the Bronze Age, the available evidence for the Tarxien Cemetery phase does not yet permit an articulated discussion of the differences between the trajectories of Borġ in-Nadur and Tas-Silġ. During the Borġ in-Nadur phase, however, a divergence in the scale of activity becomes apparent. The attraction of Borġ in-Nadur may be explained not only in terms of the oft-cited defensibility of the ridge, but also the superior connectivity that it commanded with different parts of the interior. This made Borġ in-Nadur the optimal position for an entrepot servicing and controlling seaborne trade in exotic goods with the communities across south-east Malta. The topological advantages enjoyed by Borġ in-Nadur, and the archaeological evidence available to date, lead us to think that Tas-Silġ could only have had a role subsidiary to that of Borġ in-Nadur.

The divergent life-histories witnessed on the two ridges are best attested for the Punic and Roman periods. The foremost development in this period is the progressive elaboration of the sanctuary at Tas-Silġ into a major cult centre. Its command of, and visibility from, different embarkation points may be the most

26 Cazzella and Recchia 2007: 64.
27 Cazzella and Recchia 2007: 64.

important single explanatory factor in the choice of this location. The backdrop that must be kept in mind is the new world order which, during the course of this period, came to depend increasingly on the bulk transportation of subsistence commodities criss-crossing the Mediterranean with a scale, volume and intensity of shipping that was totally unprecedented. From a seafarer's perspective, having a choice of havens facing different directions within a small area represented a rare blessing, all the more so because of two developments that characterised this period. Firstly, seaborne journeys were becoming longer and longer, making it very difficult to predict wind and weather conditions at the time of making a landfall. Secondly, the constraints of vessels with a deeper draft than those of earlier periods, and which could not be dragged ashore, made the availability of a choice of safe anchorages all the more vital. With the alternatives afforded by Marsascala, St Thomas Bay, and Marsaxlokk Harbour, an experienced sailor familiar with the coastline could make a safe landfall in any wind direction. The visibility of the sanctuary complex when it stood gleaming to its original height[28] (Fig. 8.5), from the open sea as well as from these different embarkation points, must have made it a waypoint of great significance to seafarers, as has been persuasively argued for Greek and Phoenician sanctuaries throughout the Mediterranean more generally[29]. The CSA and LCP analyses however reveal another aspect of the location of Tas-Silġ. The cost surface (Fig. 8.3) demonstrates that the site is located at a higher cost-distance from the shore than much of the surrounding territory. It does not, therefore, stand on the most economic route from the interior to the sea. This is confirmed by the least cost paths (Figs 8.1 and 8.2), practically none of which pass through the site at Tas-Silġ. This characteristic becomes all the more important with the introduction of movement of bulk commodities on beasts of burden and wheeled transport, as will be considered shortly.

[28] The visibility of such sanctuaries would have been further enhanced by the column of smoke rising from sacrificial activity in their precincts (Nicholas Vella, personal communication).
[29] Churchill Semple 1927; Vella 2005.

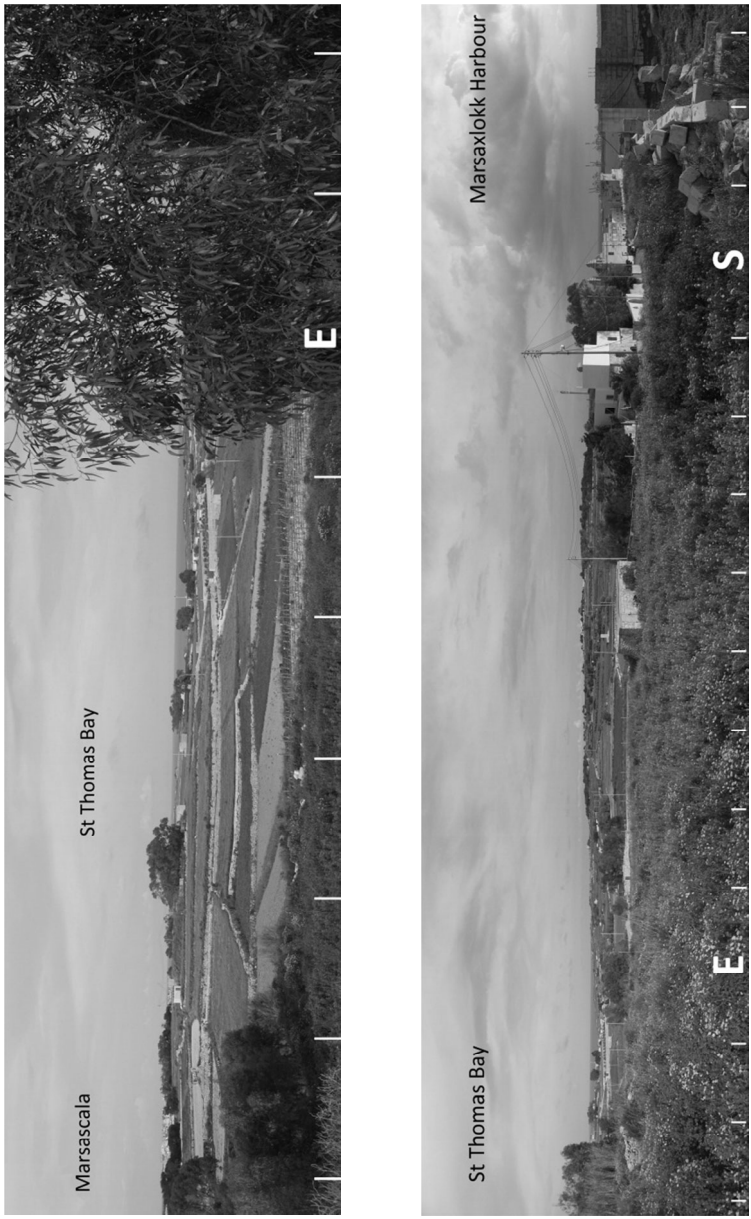

Figure 8.5. Views from the eastern side of Tas-Silġ, taken from slightly different viewpoints to avoid obstruction caused by modern vegetation.

Turning back to Borġ in-Nadur, some of the possible reasons why this site is not reused as a cult centre in the classical period are now more clear. Tucked away at the innermost end of Marsaxlokk Harbour, the site is rather less visible from outside the harbour, and even to a viewer entering the harbour, does not rise above the apparent horizon as Tas-Silġ does. In terms of maritime connectivity, unlike Tas-Silġ it only commands a single embayment, which though sheltered from the prevailing winds, does not afford the same degree of all-weather shelter afforded by the combination of creeks and bays around Tas-Silġ.

The other key development noted in the Marsaxlokk region during the classical period is the emergence of agricultural establishments at distinct locations. Their careful positioning to optimise the transportation of bulk commodities with the least effort was confirmed by the LCP analysis. Ta' Kaċċatura, though it may look remote to us today, has in fact been demonstrated by the LCP analysis to straddle a narrow but vital corridor that provided the easiest access from much of the heart of the island down to the sea. The LCP analysis has also confirmed that the villa at Żejtun lies near the point of convergence between least cost paths connecting St Thomas Bay and Marsaxlokk Bay to the interior (Figs 8.1, 8.2). It should be recalled, as noted above, that the presence of the modern built-up area of Żejtun in the DEM used may be causing some local distortion of the LCP results by pushing paths around it. Were it not for this factor, it appears that several least costs paths would run even closer to the villa site.

The fact that the sanctuary of Tas-Silġ does not seem so closely bound by the same constraints, and is relatively remote from the least cost paths, is in itself telling. Porterage of commodities in bulk was not a key consideration in a sanctuary complex, while accessibility from different landfalls for mariners completing or starting a journey evidently was.

8.8. Future research

The observations presented here raise at least as many questions as they help to answer. The preliminary results obtained are intended

to reiterate the usefulness of GIS-based engagement with the anatomy of the landscape context of archaeological activity, and to help inform and focus a research agenda for refining our understanding of interdependencies and interactions between different sites and the outside world, and of the role played by local topography in shaping the life-histories of the use of different places. The addition of three types of fresh data can in future enrich and refine the model that has been outlined here: more refined chronologies tracing the rise and fall of different sites and activities; more detail regarding a wider range and number of sites such as domestic units or funerary sites, and more information regarding the changing environment against which this human drama unfolded.

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