

11

Viking settlers in the Isle of Man: some simulation experiments

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If barrows can be used to represent both physically and symbolically a family claim to territory, the illiterate man's land charter, then isolated barrows or small barrow groups may be very significant features in the landscape (Welch 1985, p. 17).

11.1 Introduction

There exists on the Isle of Man a complex system of land division which is thought to be of great antiquity. This land system can be summarised very briefly as follows. First, the island is split into two divisions known respectively as the *Northside* and *Southside*. Both of these divisions are comprised of three *Sheadings*. A Sheading is made up of two or three *Parishes*, which are in turn sub-divided into groups of units called *Treens*. The treens are themselves a collection of land-holdings called *Quarterlands* or *Kerrows*. In essence the Manx land system is a five-tiered pyramid with the quarterland estates forming its base (11.1). Although the complete land system is not recorded before the start of the sixteenth century, it has been postulated that parts of it are due to Vikings, and perhaps even earlier.

In this paper we will attempt to explore the theory that the Manx quarterlands may have been recognisable units in the early Viking period.

11.2 Manx quarterlands

Manx customary land tenure was based upon the quarterland or *kerrow*, which formed the characteristic holding of a freeholder, and represented the primary, and indivisible, unit of inheritance between ancestor and heir (Farrant 1937, 10, 12, 17). In terms of size, the quarterlands were generally between 50 and 180 acres, with a fairly symmetrical distribution around a mode of 90 acres. Occupying the best farming areas, they avoided land at altitudes higher than 170–200 metres and marshy areas, and there was also a marked tendency towards equitable division when the quality of the land is considered (see Davies 1956, pp. 109–10). The units were basically agricultural units which could support several nuclear families.

The word quarterland only appears for the first time in the Manx Statutes of 1593 (Gill 1883, p. 64). However, a full inventory of the Manx quarterlands is given in the so-called Manx

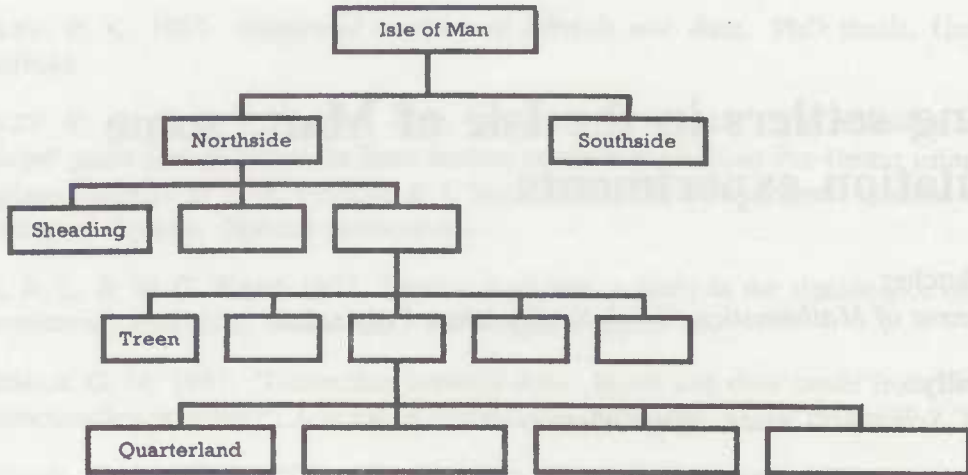


Fig. 11.1: Principle land divisions of the Isle of Man

Manorial Rolls which date from the beginning of the sixteenth century (Crellin 1969; Talbot 1924).

Many of the estates named in these documents were evidently established much earlier as a Sheading Court Roll of 1417–18 clearly demonstrates (Megaw 1976, pp. 12–13). On documentary grounds alone, therefore, there is no evidence that the Manx quarterland system is earlier than the fifteenth century. Yet despite this, scholars have often claimed that the system was introduced in the first millennium AD. In support of this they often draw parallels between the structure of the Manx land system and other land systems which are also thought to be ancient artefacts (e.g., Marstrander 1937; Marwick 1935).

The Vikings certainly had a major impact on the Isle of Man, and by the end of the eleventh century the island was the capital of an important Viking Kingdom (Broderick 1979). This theory is particularly intriguing as it is not known for certain when, in what numbers, or on what terms the earliest Scandinavians came to the Isle of Man. Although Scandinavian freebooters are known to have been harrying ecclesiastical centres around the coast of the Irish Sea from the end of the eighth century, the presence of Vikings on Man is not attested until around the turn of the millennium when a set of about 30 pagan-Viking graves appears in the archaeological record (Bersu & Wilson 1966; Freke 1983, Freke 1984, Freke 1985; Wilson 1974). These graves are distinguished by the presence of characteristically Viking artefacts.

The Manx pagan-Viking graves are confined to very narrow time brackets, becoming archaeologically invisible from the second quarter of the tenth century. The normal explanation for this is that the Manx-Scandinavians were converted to Christianity and subsequently buried their dead without grave-goods. This process of conversion is reflected in the emergence and development of memorial crosses, bearing pagan and then Christian motifs and executed in a Scandinavian style, from the second quarter of the tenth century (Cubbon 1977; Wilson 1967, Wilson 1968, Wilson 1971, Wilson 1983).

The Manx Viking grave assemblages have been subjected to a good deal of scholarly attention, and the analysis of what, in Lewis Binford's terms, is the *social persona* of the people placed in these tombs has been conducted at a detailed level. In marked contrast to this is the relative neglect of the social group who were responsible for disposing of these people in this way. The phenomenon of disposing of the dead in richly furnished and conspicuous grave-mounds is known in many different places and times. In recent years, sociological theory has influenced much archaeological thinking, especially by prehistorians, and consequently much more thought has been devoted to wider economic and social implications of such burial formations (Bartel 1982).

11.3 Viking farmsteads in Jurby?

Over 35 years have elapsed since it was first suggested by Basil and Eleanor Megaw that the distribution of the set of Viking burial mounds in the northern parish of Kirk Patrick of Jurby should be associated with the arrangement of quarterland estates in the parish (Megaw & Megaw 1950). Excavations by Gerhard Bersu in the 1940s had demonstrated that the rituals involved in the Manx-Viking grave-mounds was directly analogous to those described in eye-witness account of the burial of a Viking leader on the shores of the Volga in AD 921 (Bersu & Wilson 1966, pp. 88–92). According to the testimony of a tenth-century Arab diplomat, Ibn Fadlan, a third of all the deceased's portable wealth was buried with the corpse, with the remainder being divided between kin and friends. Bersu hypothesised that the mounds themselves represented an extension of the ritual and symbolised the dead man's lands (Bersu 1968, p. 85). However, there is no historical basis for this speculation. In any case, land, in early medieval society, was more often regarded as belonging to a kindred group rather than to an individual as private property (Charles-Edwards 1972).

In 1976 Basil Megaw proposed that the Jurby grave-mounds should be seen as the burials of pagan-Viking mercenaries who had been deliberately settled in a strategically vulnerable part of the island as defence against other potential aggressors. In other words the parish of Jurby may be regarded as the earliest Scandinavian enclave on the island, with the grave-mounds reflecting the settlements or estates of the first generation of pagan-Viking settlers. The erection of these mounds not only served to entomb the deceased, but in a sense reiterated a claim by a wider corporate group to the surrounding lands. The premise is that the people who placed the dead Vikings in these conspicuous and richly furnished graves not only acknowledged a social bond to the deceased by submitting them to such an expensive ritual, but also established a claim to the land in restating the existence of that social bond in the burial ritual. The Jurby grave-mounds are, according to this view, very much the land charters of illiterate men.

A competing theory sees the placement of the grave-mounds being determined by a desire to locate them on prominent spots with a view of the sea rather than being associated with the productive resources of a settlement unit (Bersu 1957). Since several grave-mounds are situated well inland this latter theory does not provide a completely adequate explanatory model.

The assumption that the spatial patterning of burials in some way reflects the social world of the community that produced them is not unprecedented (*e.g.* Fleming 1973; Hodson 1979). Prehistoric grave-mounds in Britain, for instance, have been interpreted variously as territorial foci by Colin Renfrew (Renfrew 1973, Renfrew 1976) and as attention-focusing devices designed to reinforce existing patterns of leadership by Andrew Fleming (Fleming 1973). The prehistorian Richard Bradley and the Anglo-Saxonist John Shephard have both noted that the setting up of mounds to commemorate the dead stresses the importance of ancestry as well

as establishing an hereditary claim to the resources they once controlled (Bradley 1984, p. 6, 15; Shephard 1979, p. 47).

Indeed, it is known that grave-mounds often provided special settings for important inaugural rituals in Early Medieval Scandinavia. For example, king-making ceremonies were often performed on ancestral burial mounds (Davidson 1964). In relation to this, it is relevant that the Manx Parliament is still convened on Midsummers Day at the large burial-mound called Tynwald Hill or the Hill of Promulgations (Craine 1976).

Strangely, from the Megaws' initial observation until the present, it has been usual for commentators to refer to the distribution of only the small subset of Jurby grave-mounds which lie close to the coast (*e.g.* Bersu 1957, Bersu & Wilson 1966, Megaw 1976, Megaw 1978, Wilson 1974). The most recent and clearest exposition regarding this phenomenon has been offered by Basil Megaw, who states that:

Six out of eight quarterland farms on the coastal ridge each appear to have been distinguished by a prominently-sited grave-mound, perhaps the burial places of the Norse settlers. The distribution would seem to support the identification of the farm-units of the ninth century with the traditional quarterland farms (Megaw 1978, p. 283).

The emphasis on just these six mounds is surprising because it ignores the presence of a number of other grave-mounds in the parish, despite the inclusion of several of them in the published distribution maps (Craine 1948; Megaw 1976 republished in Megaw 1978). In fact it is possible to account for the presence of thirteen grave-mounds in Jurby (Fig. 11.2).

Until now no published analysis has attempted to accommodate all the known grave-mounds in the parish. Furthermore, no previous attempt has been made to refute or support Megaw's impressionistic analysis of this distribution. The principal aim of the remainder of this paper is to attempt to formalise the observation made by Megaw and to test it rigorously.

11.4 The Data

First it is necessary to mention the quality of the data being examined. Several commentators have remarked on the formerly very superstitious nature of the rural population of Man (*e.g.* Cubbon 1968, v; Stenning 1950, p. 260). No longer the potent force it once appears to have been, superstition has played an important rôle in the preservation of these grave-mounds. For example, the Ballateare grave-mound stood in the middle of a farmyard and yet

had survived centuries of agricultural activity, protected by the belief that anyone digging into an old mound—and it was regarded as such—would suffer a terrible punishment (Bersu & Wilson 1966, p. 45).

Some of these grave-mounds have been destroyed or damaged in recent times as a direct result of modern farming practices or the encroachments of the sea, but their former locations have been preserved in local tradition, place-names, and documentary sources. This gives us some confidence for assuming that the known distribution of pagan Viking grave-mounds is virtually complete, especially in Jurby where the study of Viking Age grave-mounds has been most intense. To recap, then, for the purposes of this study thirteen grave-mounds have been provisionally accepted as the graves of pagan Vikings.

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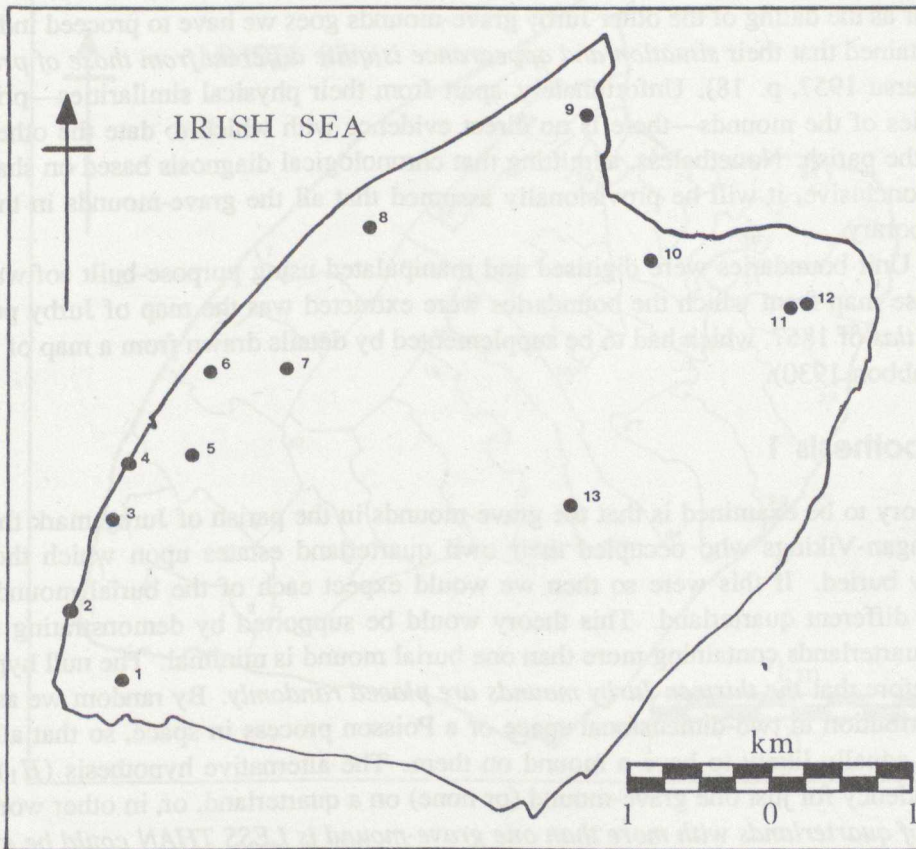


Fig. 11.2: Distribution map showing the locations of the Jurby grave-mounds

(1) Cronk Killane, (2) Cronk Elliot, (3) Cronk Moar, (4) "little mound", (5) nameless, (6) Cronk ny Arrey Laa, (7) Cronk ny Holloe, (8) Cronk y Cliwe, (9) Cronk Breck, (10) Cronk y Vargee, (11) Knock y Dowan (a), (12) Knock y Dowan (b), (13) Cronk Mwyllin

have been preserved in local tradition, place-names, and documentary sources. This gives us some confidence for assuming that the known distribution of pagan Viking grave-mounds is virtually complete, especially in Jurby where the study of Viking Age grave-mounds has been most intense. To recap then, for the purposes of this study thirteen grave-mounds have been provisionally accepted as the graves of pagan Vikings. These are distributed over 34 primary units (Figs. 11.3 and 11.4).¹

Only three of the Jurby grave-mounds have been excavated, and each of them are dated on the basis of artefacts found within them to the late ninth/early tenth century (Bersu & Wilson 1966). Several other Viking grave-mounds located elsewhere on the island are also of this time band. As far as the dating of the other Jurby grave-mounds goes we have to proceed inductively. Bersu maintained that their *situation and appearance is quite different from those of prehistoric barrows* (Bersu 1957, p. 18). Unfortunately, apart from their physical similarities—principally in the profiles of the mounds—there is no direct evidence with which to date the other grave-mounds of the parish. Nonetheless, admitting that chronological diagnosis based on shape is by no means conclusive, it will be provisionally assumed that all the grave-mounds in the parish are contemporary.

The land Unit boundaries were digitised and manipulated using purpose-built software. The principal base map from which the boundaries were extracted was the map of Jurby published in *Woods' Atlas* of 1867, which had to be supplemented by details drawn from a map of William Cubbon (Cubbon 1930).

11.5 Hypothesis 1

The first theory to be examined is that the grave-mounds in the parish of Jurby mark the burial places of pagan-Vikings who occupied their own quarterland estates upon which they were subsequently buried. If this were so then we would expect each of the burial mounds to be located in a different quarterland. This theory would be supported by demonstrating that the number of quarterlands containing more than one burial mound is minimal. The null hypothesis (H_0) is therefore that *the thirteen Jurby mounds are placed randomly*. By random we assume a uniform distribution in two-dimensional space or a Poisson process in space, so that all points in Jurby are equally likely to have a mound on them. The alternative hypothesis (H_1) is that there is a tendency for just one grave-mound (or none) on a quarterland, or, in other words, that *the number of quarterlands with more than one grave-mound is LESS THAN could be expected by random chance*.

We wish therefore to investigate a random variable which we can call X which is the number of primary units containing more than one mound out of the total of thirty-four primary units. The distribution of this random variable X needs to be determined assuming the null hypothesis to be true, so that the significance of the observed result can be measured. One possibility would be to calculate the probability distribution of X using an analytical technique. However, since the areas of the individual units in Jurby vary considerably this option is very involved and unattractive. This becomes all the more so if one intends to apply the technique to a much larger sample of land units of widely diverging areas. A much more appealing alternative is to simulate the probability distribution.

Essentially the technique adopted here is to use Monte Carlo techniques to simulate the theoretical distributions of site locations that satisfy the assumptions of the null hypotheses.

¹A full account of the evidence for the thirteen Jurby grave-mounds will be presented elsewhere (Reilly forthcoming).

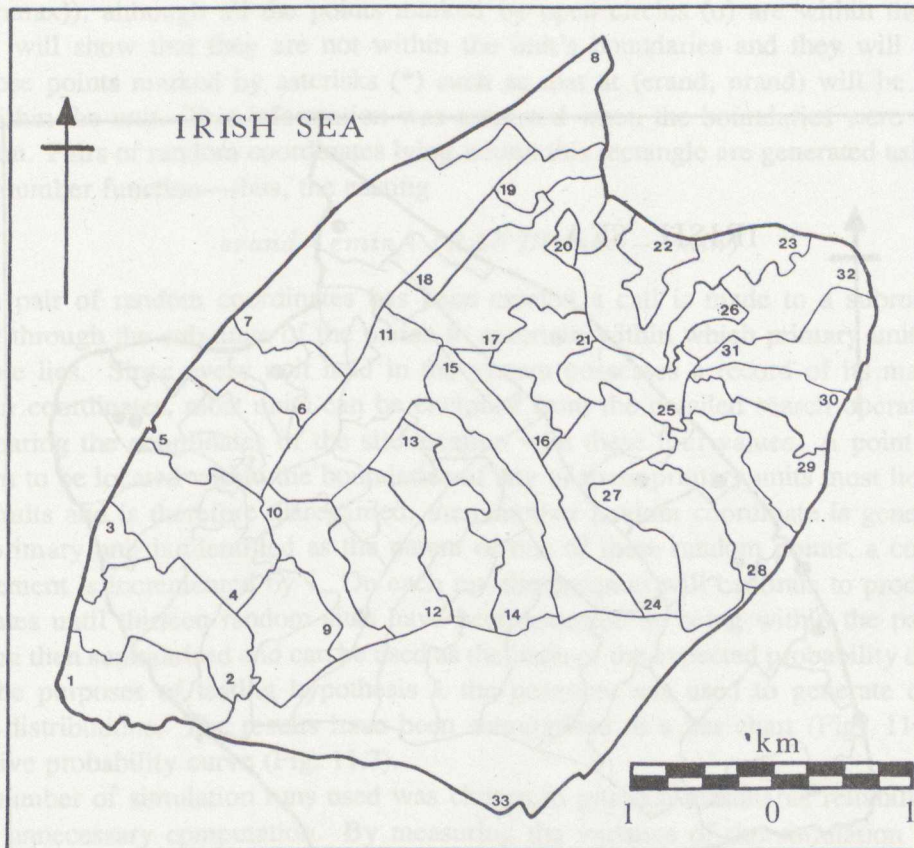


Fig. 11.3: Primary divisions in the parish of Kirk Patrick of Jurby, Isle of Man
 (1) Ballateare, (2) Ballasalla, (3) Cronk Moar, (4) West Nappin, (5) East Nappin, (6) Sartfield, (7) Kerrow-ny-Genny/Garrow, (8) Intack, (9) Ballacaine, (10) Ballawoirrey, (11) Kerrowquirk, (12) Ballavarran, (13) Ballamoar, (14) Ballameanagh, (15) Berrag, (16) Ballagaraghan, (17) Bretney, (18) Ballagaie, (19) Ballagaraghan, (20) Ballagaraghan, (21) Loughan, (22) Vicar's Glebe, (23) Ballaconley, (24) Ballacurry, (25) Intack, (26) Cooldhoo, (27) Kerrowkneale, (28) Rendoo, (29) Kerrowcroie, (30) Ballachristery, (31) Ballalig, (32) Ballachrink, (33) Ballameanagh Intacks

have been preserved in local contexts, some others, and documentary sources. This gives us some confidence for assuming that the known distribution of pagan Viking grave-mounds is virtually complete, especially in Jurby where the study of Viking Age grave-mounds has been most intense. To recap then, for the purposes of this study, all pagan grave-mounds have been provisionally accepted as the graves of pagan Vikings. These are distributed over 34 primary units (Figs. 11.3 and 11.4).

Only three of the Jurby grave-mounds have been excavated, and each of them are dated on the basis of radiocarbon dates within their in situ subsidiary earth-urns (Petersen & Wilson 1966). Several other Viking grave-mounds located elsewhere on the island are also of this time

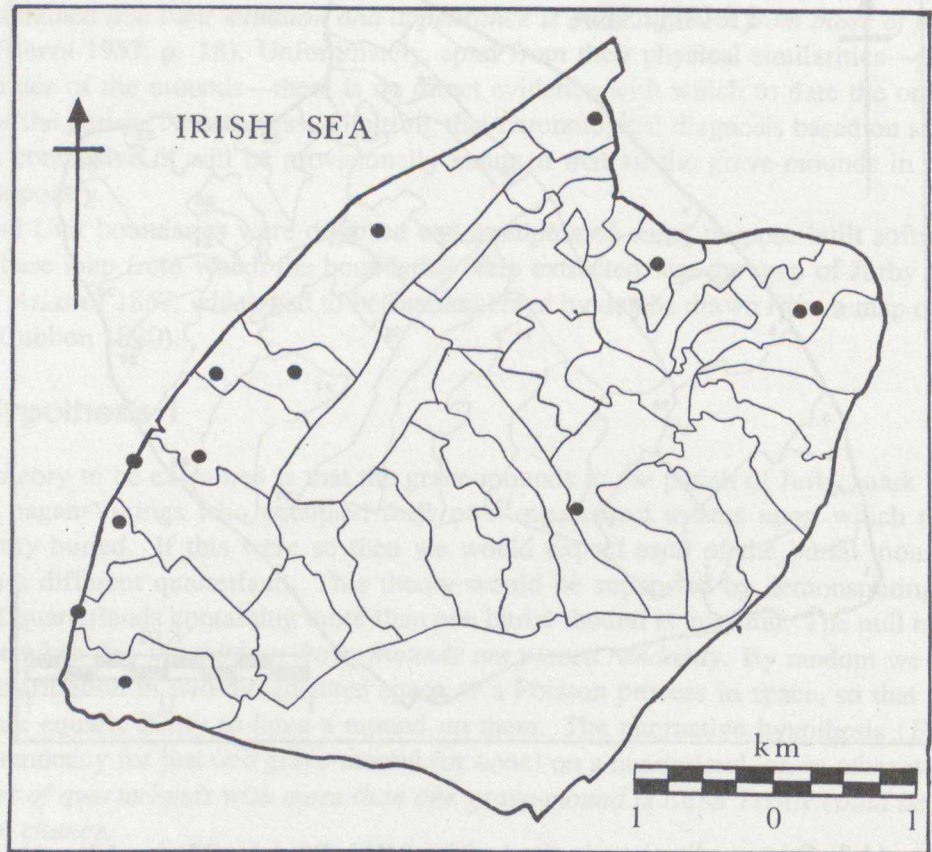


Fig. 11.4: The distribution of the Jurby grave-mounds over the primary units

The theoretical and observed distributions may then be compared. The probability distribution is estimated by generating sequences of thirteen random site-locations, or points, each equivalent to one of the recorded grave-mound sites within the parish, and counting the number of points located in each quarterland on every run.

A program called JURBYSIM was written to carry out this task². The method used by the program is illustrated in Fig. 11.5. It first obtains the maximum and minimum coordinates defining the vertices of the smallest rectangle enclosing the parish (*i.e.* (e_{min} , n_{min}) and (e_{max} , n_{max})), although all the points marked by open circles (o) are within the range, the program will show that they are not within the unit's boundaries and they will be rejected. Only those points marked by asterisks (*) such as that at (e_{rand} , n_{rand}) will be accepted as being within the unit. This information was extracted when the boundaries were entered into the system. Pairs of random coordinates lying within this rectangle are generated using a simple random number function—thus, the easting

$$e_{rand} = e_{min} + IRAND(e_{max} - e_{min})$$

Once a pair of random coordinates has been created a call is made to a subroutine which searches through the sub-units of the parish to ascertain within which primary unit, if any, the coordinate lies. Since every unit held in the system possesses a record of its maximum and minimum coordinates, most units can be excluded from the detailed search operations simply by comparing the coordinates of the site-location with these four values. A point that cannot be shown to be located within the boundaries of any of these primary units must lie outside the parish limits and is therefore disregarded; then another random coordinate is generated. Each time a primary unit is identified as the parent of one of these random points, a corresponding array element is incremented by 1. On each run the program will continue to produce random coordinates until thirteen random sites have been accepted as being within the parish. These values are then summarised and can be used as the basis of the expected probability distributions.

For the purposes of testing hypothesis 1 the program was used to generate one hundred random distributions. The results have been summarised in a bar chart (Fig. 11.6) and as a cumulative probability curve (Fig. 11.7).

The number of simulation runs used was chosen to produce reasonable reliability of results without unnecessary computation. By measuring the variance of the simulation results, it is possible to calculate 95% confidence limits for the percentages to be used. With 100 runs a percentage estimated as 80% will have 95% confidence limits of $80\% \pm 7\%$, which is accurate enough for our purposes. (Similar arguments have been used in determining the sizes for the simulations).

The results show that if thirteen sites are randomly distributed over the 34 primary units of Jurby we can expect, on average, two of the primary units to contain more than one of the randomly generated site locations. In actuality the observed number of primary units containing more than one grave-mound is also two. The simulations show that the probability of obtaining two or more units with more than one randomly placed site-location is very high. To be precise there is an $80\% \pm 7\%$ probability of such an occurrence. As the probability is clearly not small of obtaining by random chance two or more primary units with more than one grave-mound on them, the observed result of two is not significantly different from the results expected under the null hypothesis. The null hypothesis is therefore accepted and it is concluded that this test offers no support for hypothesis 1.

²This program utilises several of the FORTRAN modules employed by the BOUNDER (Reilly & Zambardino 1985) and BOUNDERII (Reilly & Zambardino, forthcoming) systems.

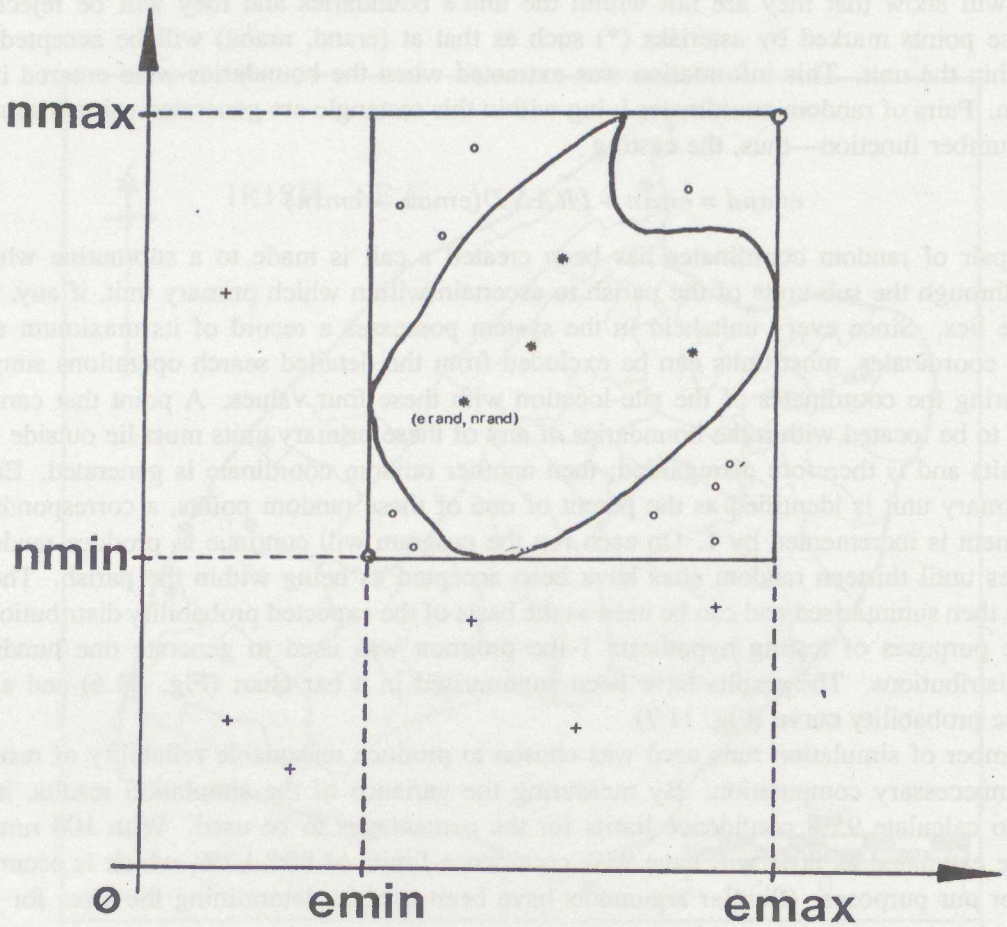


Fig. 11.5: Generating a random co-ordinate within a specified area

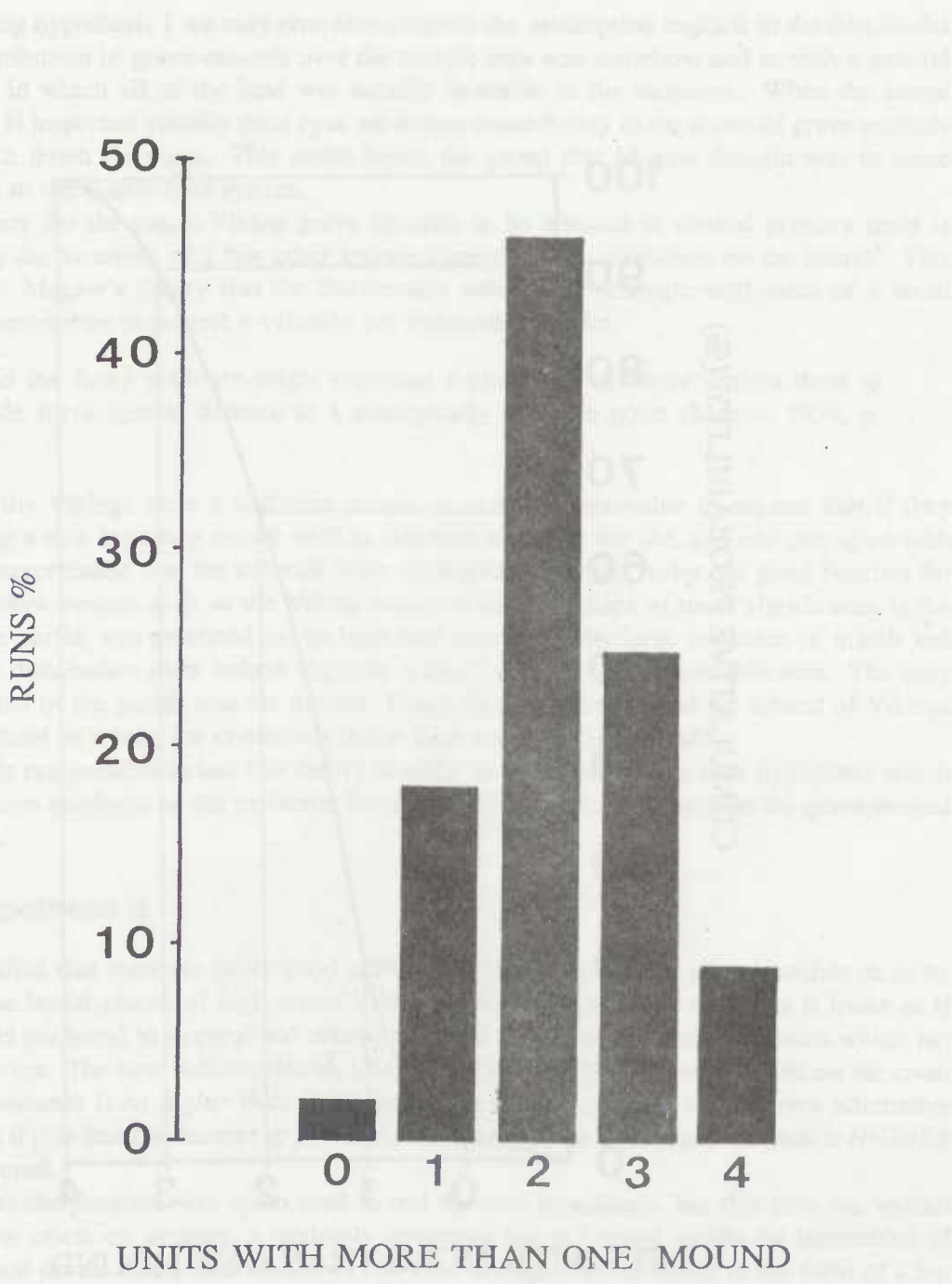


Fig. 11.6: Bar chart showing the estimated probability of units having more than one mound

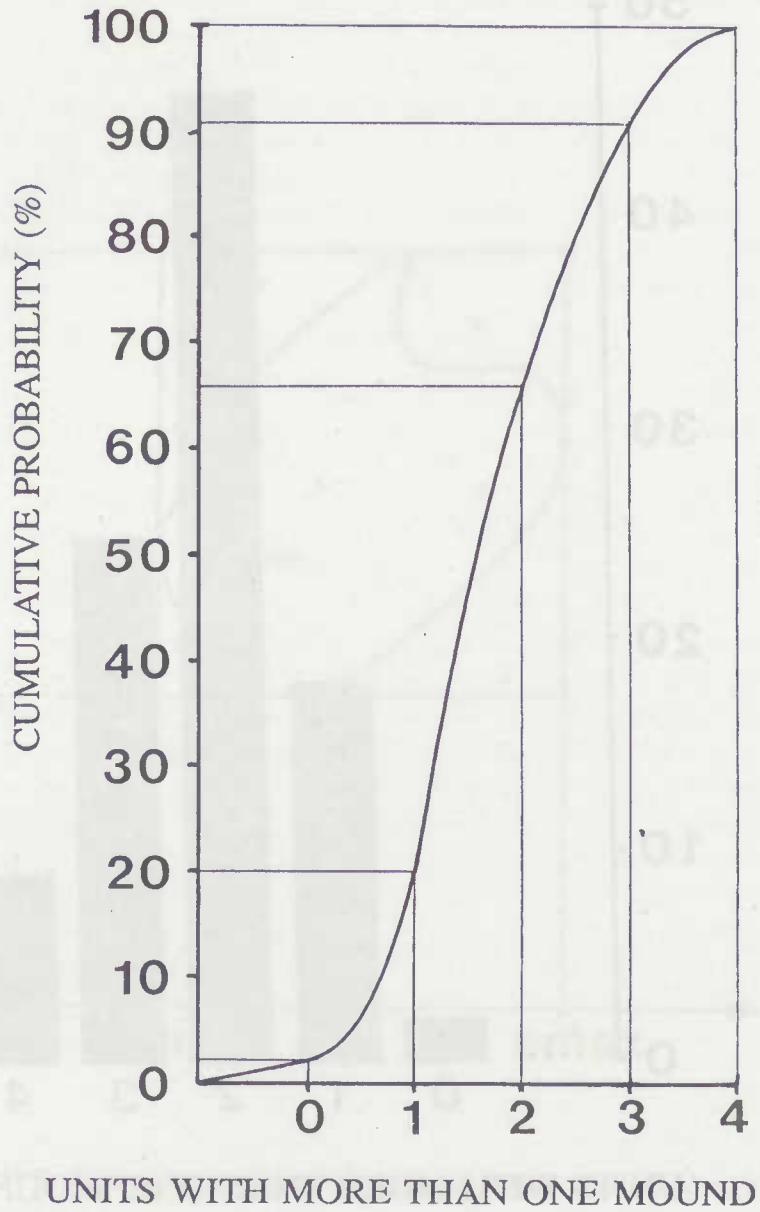


Fig. 11.7: Cumulative frequency curve of units with more than one mound

In rejecting hypothesis 1 we may now also suspend the assumption implicit in the first model that the distribution of grave-mounds over the sample area was somehow tied in with a general land-taking in which all of the land was equally desirable to the incomers. When the actual distribution is inspected visually one's eyes are drawn immediately to the series of grave-mounds which march down the coast. This series forms the group that Megaw thought was in some way related to the quarterland system.

A tendency for the pagan-Viking grave mounds to be situated in coastal primary units is hinted at by the locations of a few other known examples from elsewhere on the island³. This brings us to Megaw's theory that the distribution reflects the strategic settlement of a small group of mercenaries to protect a valuable yet vulnerable district.

Indeed the Jurby evidence might represent a plantation of Norse settlers there to provide for a coastal defence at a strategically sensitive point (Megaw 1978, p. 299).

Given that the Vikings were a seafaring people, it is not unreasonable to assume that if they were settling a new land they would wish to maintain access to the sea, and one can agree with Megaw's interpretation that the mounds were strategically placed. Jurby has good beaches for landing shallow vessels such as the Viking mariners used. Perhaps of more significance is the fact that the parish was protected on its landward boundaries by large expanses of marsh and rivers. The distribution does indeed suggest a small enclave in a defensible area. The only easy route out of the parish was via the sea. Could this be a beach head for a band of Vikings using the island as a base for operations in the Irish sea or on the island?

While it is not possible to test this theory directly we may formulate a new hypothesis which places far more emphasis on the particular locational attributes that characterise the grave-mound distribution.

11.6 Hypothesis 2

It is established that there are fairly good reasons for assuming that the grave-mounds in Jurby represent the burial places of high status Viking settlers. On the face of things it looks as if these settlers preferred to occupy and subsequently be buried on quarterland estates which ran down to the sea. The new null hypothesis (H_0) is that *the number of primary units on the coast with grave-mounds is no higher than that expected by random chance*, and our new alternative hypothesis (H_1) is that *the number of primary units on the coast with grave-mounds is HIGHER THAN expected*.

The JURBYSIM program was again used to test the new hypothesis, but this time we wished to know how often, on average, a randomly generated site is located within the boundaries of a primary unit on the coast. The results of 100 runs are again summarised in the form of a bar chart and a cumulative probability distribution curve (Figs. 11.8 & 11.9).

It can be seen from Fig. 11.9. that the probability of having two or fewer primary units on the coast with grave-mounds is 49%; that for three or fewer rises rapidly to 81%; that of having four or fewer to 96%; that of having five or fewer is 96%; and finally that of obtaining

³The grave-mounds examined at Ballalby, Kirk Patrick (Oswald 1860, pp. 77-78), Knock-y-Doonee (Kermode 1930) and Balladoole (Bersu & Wilson 1966) are situated in prominent coastal positions. Two other grave-mounds thought to be of Viking origin which have been examined, one at Ronaldsway (Wilson 1974, 45), Kirk Malew and the other on Saint Patrick's Isle (Megaw & Megaw 1950, p. 145), also lie in similar situations (*i.e.*, in primary units on the coast).

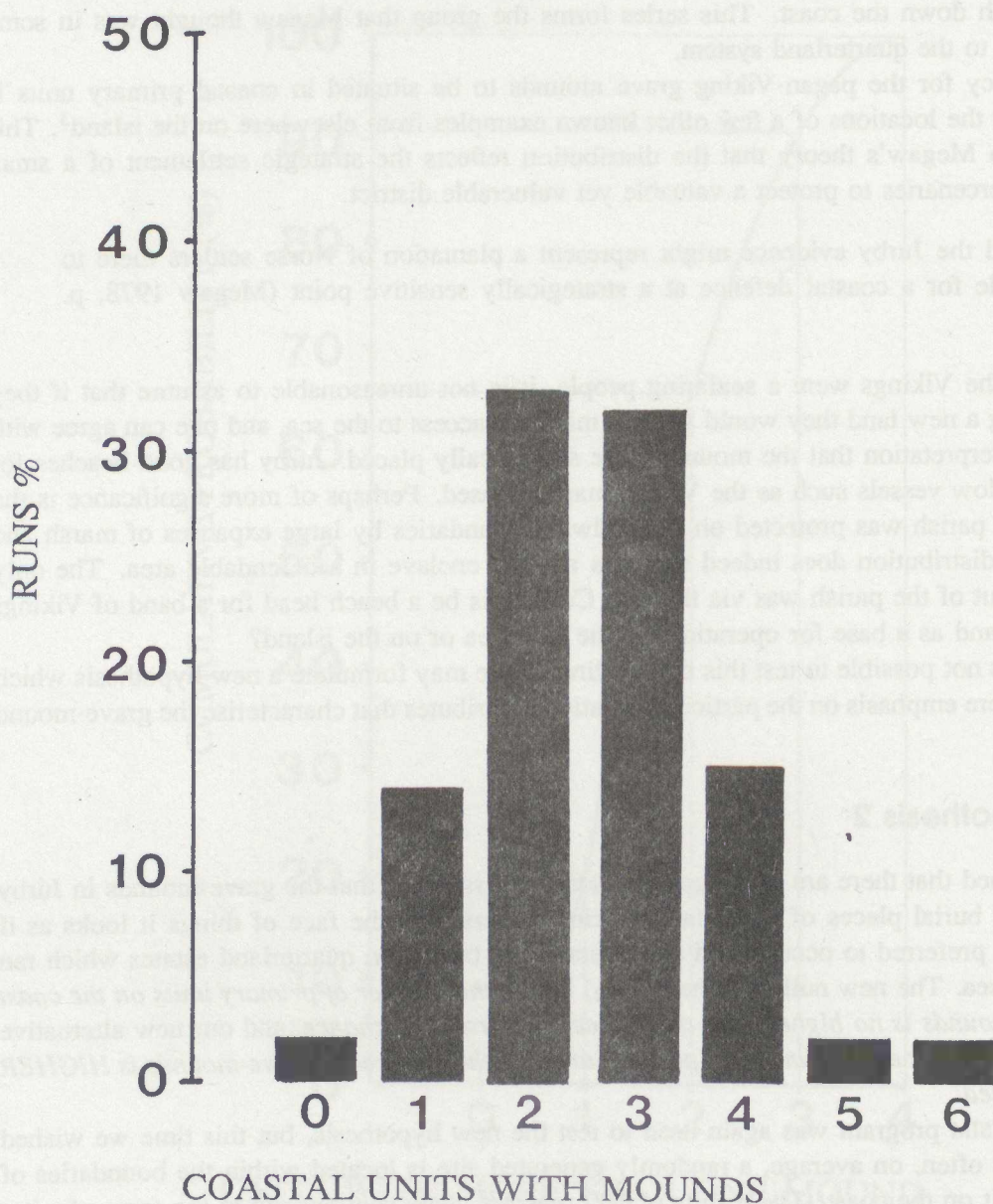


Fig. 11.8: Bar Chart showing the estimated probability of coastal units having mounds

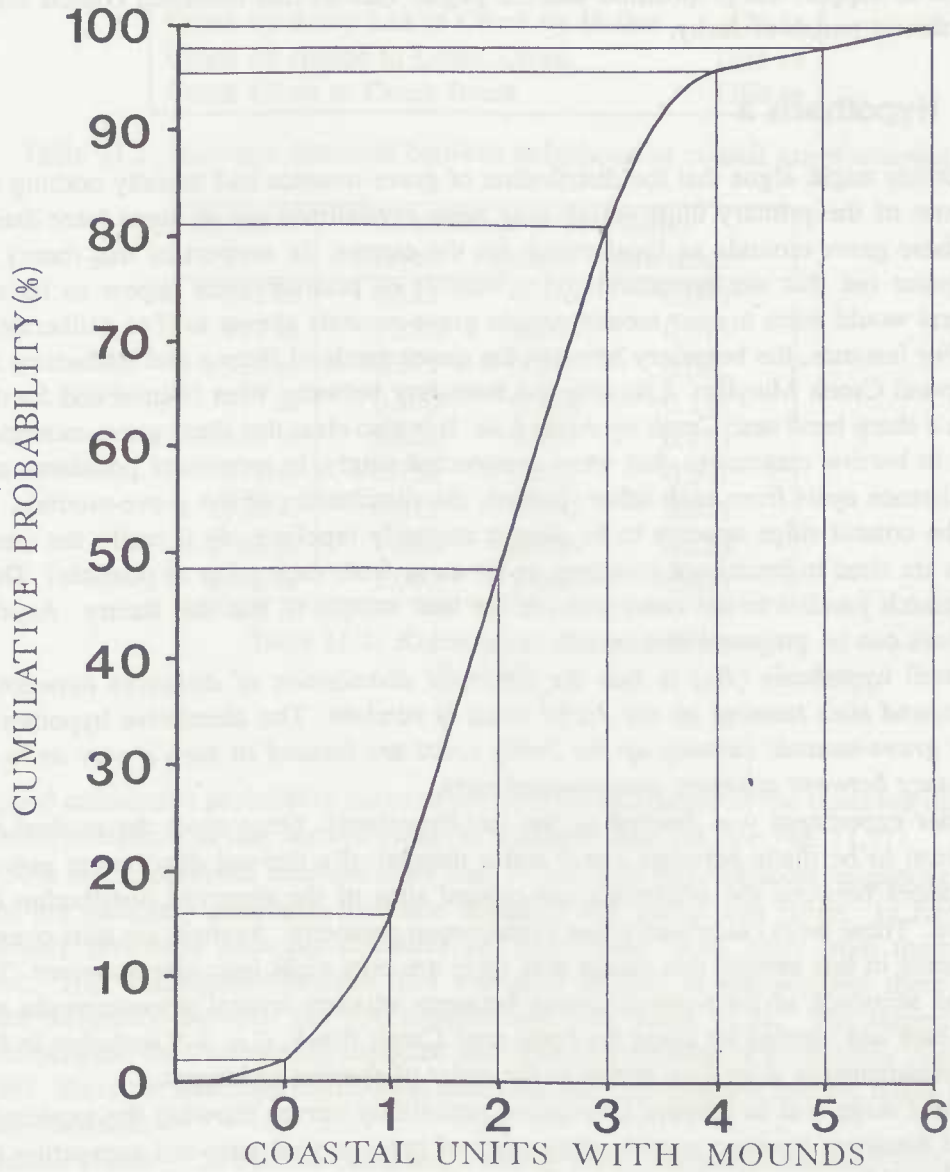


Fig. 11.9: Cumulative frequency curve of coastal units having mounds

six or fewer primary units on the coast with grave-mounds is 100%. The chances of having grave-mounds erected on MORE THAN seven of these coastal units is therefore less than 1%. In fact the observed distribution shows that all eight primary units on the coast of Jurby contain grave-mounds. The null hypothesis (H_0) is therefore rejected with at least 99% confidence and the alternative hypothesis (H_1) accepted. The result of this test is that we have strong statistical evidence to support the proposition that the pagan-Vikings had restricted coastal settlement in the northwest parish of Jurby.

11.7 Hypothesis 3

Some critics might argue that the distribution of grave-mounds had initially nothing to do with the layout of the primary units which may have crystallised out at some later date, perhaps using these grave-mounds as focal points for the estates. In support of this theory, the critic might point out that the boundaries of a number of primary units appear to have kinks in them, and would seem to veer around certain grave-mounds almost as if to deliberately include them. For instance, the boundary between the quarterlands of Berreg and Ballacurry appears to veer around Cronk Mwyllin. Likewise the boundary between West Nappin and Sartfield turns through a sharp bend near Cronk ny Arrey Laa. It is also clear that these grave-mounds were not erected in barrow cemeteries, but were constructed singly, in prominent positions, and placed some distance apart from each other. Indeed, the distribution of the grave-mounds, especially along the coastal ridge appears to be almost mutually repellent. Is it really the case that the mounds are sited in prominent positions as far away from each other as possible? The mounds which march parallel to the coast provide the best sample to test this theory. Another set of hypotheses can be proposed and tested.

The null hypothesis (H_0) is that *the observed distribution of distances between adjacent grave-mound sites running up the Jurby coast is random*. The alternative hypothesis (H_1) is that *the grave-mounds running up the Jurby coast are located in such a way as to maximise the distance between adjacent grave-mound sites*.

Another experiment was devised to test this hypothesis. Once again the method requires a comparison to be made between a real and a theoretically derived distribution pattern. First, the distances between the adjacent grave-mound sites of the observed distribution had to be measured. These were calculated using Pythagorean geometry. As there are nine coastal grave-mound sites in this sample this means that there are only eight inter-site distances. Table 11.1 gives the sequence of inter-site distances between adjacent coastal grave-mounds starting at Cronk Teare and moving up along the coast until Cronk Breck, (*i.e.* 1–9 inclusive in Fig. 11.2). These measurements were then sorted in the order of shortest to longest.

The next stage was to prepare cumulative probability curves showing the expected and the observed distances between neighbouring pairs of grave-mound sites and comparing the two.

A theoretical probability distribution of inter-site distances between randomly spaced grave-mound sites was generated for comparative purposes. Before the theoretical distributions could be produced it was necessary clearly to demarcate the area from which the sample was to be drawn. The sample area was defined as the group of primary units forming the coastal zone (Fig. 11.10). Once again the production of the theoretical distribution involves generating sequences of random coordinates over the sample area. For this purpose 50 runs were generated of nine random site-locations within the coastal zone. On each run the nine locations were sorted on their northing coordinates (since the coastal ridge in Jurby runs approximately north-south) and the shortest Euclidean distance between each adjacent pair of site-locations was calculated.

Adjacent grave-mounds	Distance
Cronk Killane to Cronk Elliot	511 m
Cronk Elliot to Cronk Moar	665 m
Cronk Moar to Little Mound	147 m
Little mound to East Nappin	671 m
East Nappin to Cronk ny Arrey Laa	571 m
Cronk ny Arrey Laa to Cronk ny Holloe	472 m
Cronk ny Holloe to Cronk Cliwe	1355 m
Cronk Cliwe to Cronk Breck	1708 m

Table 11.1: Inter-site distances between neighbouring coastal grave-mounds

Distance	Cumulative probabilities		
	observed	expected	difference
142 m	0.125	0.030	0.095
472 m	0.250	0.265	0.015
511 m	0.375	0.283	0.092
571 m	0.500	0.348	0.152
665 m	0.625	0.435	0.190
671 m	0.750	0.443	0.307 *
1355 m	0.875	0.800	0.075
1708 m	1.000	0.880	0.120
5576 m	1.000	1.000	0.000

Table 11.2: Kolmogorov-Smirnov Test
 $D=0.307$

A stepped cumulative probability curve of the inter-site distances of the observed distribution may now be compared to that derived from the synthetic data set (see Fig. 11.11).

Only 50% of the observed sites are more than 571m from their adjacent neighbour, whereas 65.2% of the randomly generated inter-site distances fall within this range. In fact 50% of the randomly generated inter-site distances are more than 780m apart from their adjacent neighbour. The Kolmogorov-Smirnov test was then applied to test whether there was any significant difference between the two distributions (see Table 11.2). The largest absolute difference between the theoretically expected and observed cumulative probability distributions, D , is 0.307. Since the sampling distribution under the null hypothesis is known, tables of critical values are available.

It turns out (Table 11.3) that the calculated value of the Kolmogorov-Smirnov statistic (D) is less than the tabled critical value with 8 degrees of freedom at the 20% level (*i.e.* 0.307 is less than 0.358). The null hypothesis is therefore accepted, and we can conclude that the spacing of

Degrees of Freedom	Significance levels				
	0.20	0.15	0.10	0.05	0.01
8	0.358	0.381	0.411	0.457	0.543

Table 11.3: Tabled Critical Value, D (source Ebdon 1979)

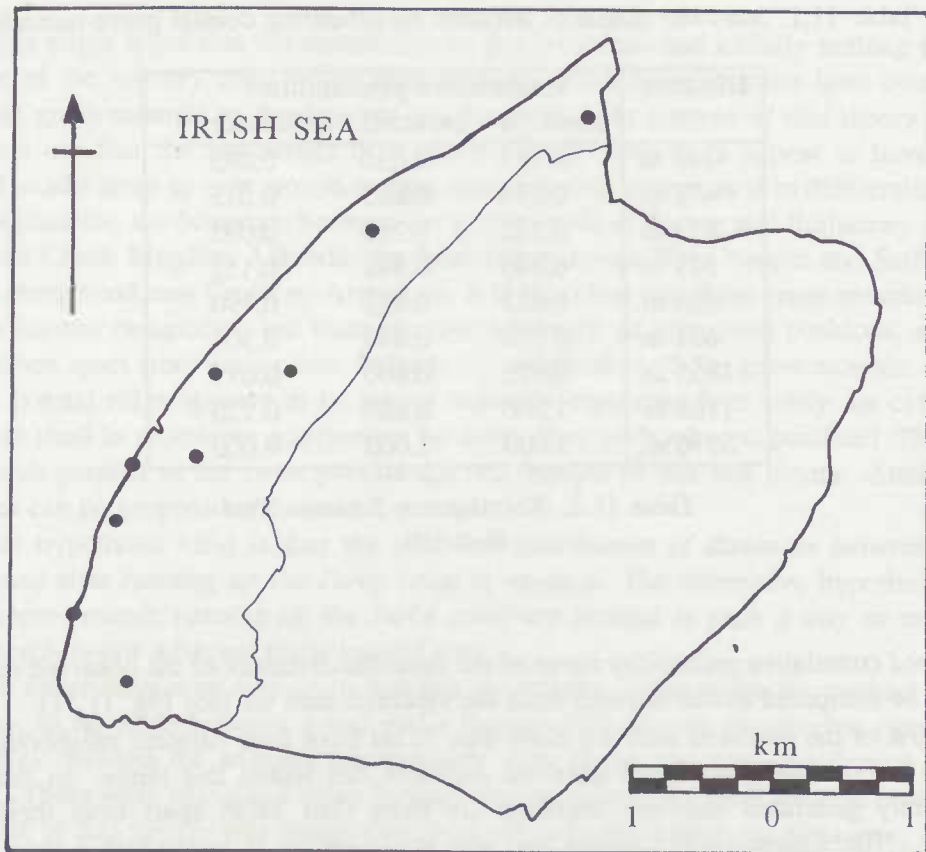


Fig. 11.10: Grave-mounds on the coastal ridge of Jurby

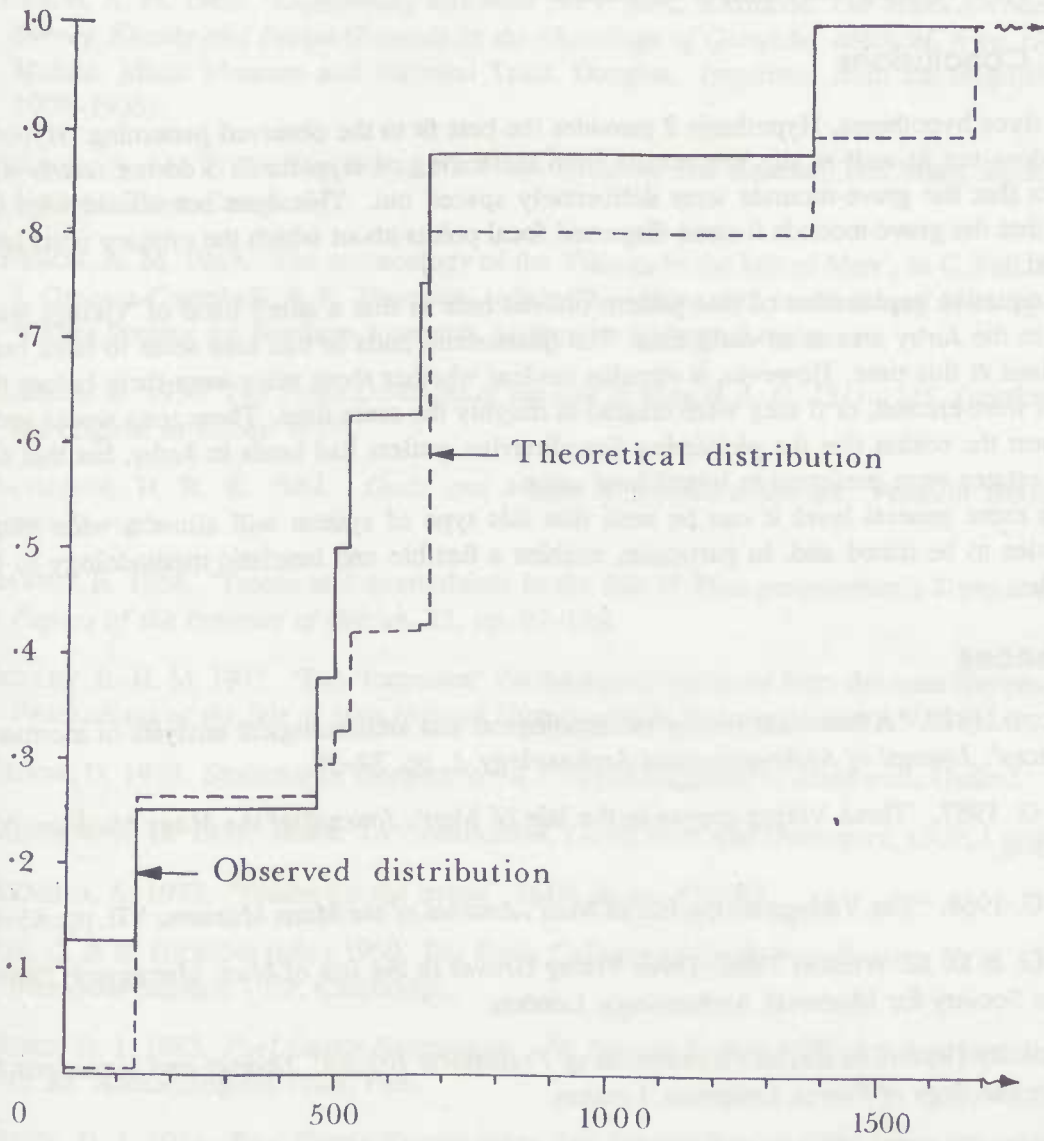


Fig. 11.11: Cumulative probability distributions for the Kolmogorov-Smirnov test
The vertical axis represents the cumulative probability, the horizontal axis represents the inter-site interval.

the Jurby grave-mounds (in terms of straight-forward Euclidean distance measurements), is not significantly different from that expected with a random distribution. In other words this test provides no evidence to suggest that these grave-mounds were placed as far away as possible from adjacent grave-mounds along the coastal zone. If a Kolmogorov-Smirnov two-sample test is used the results are still far from significant.

11.8 Conclusions

Of the three hypotheses, Hypothesis 2 provides the best fit to the observed patterning. Hypothesis 1 does not fit well at all. The results from the testing of Hypothesis 3 do not match with the idea that the grave-mounds were deliberately spaced out. This does not accord with the theory that the grave-mounds formed dispersed focal points about which the primary units later emerged.

The tentative explanation of this pattern offered here is that a small band of Vikings were settled in the Jurby area at an early date. The quarterland units in this area seem to have been recognised at this time. However, it remains unclear whether these units were there before the mounds were erected, or if they were created at roughly the same time. These tests would seem to support the notion that the pioneering Scandinavian settlers had lands in Jurby, but that the coastal estates were preferred to inland land units.

On a more general level it can be seen that this type of system will allow a wide range of theories to be tested and, in particular, enables a flexible and heuristic methodology to be pursued.

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12.1 Introduction

In the past 20 years there has been a revival of interest in archaeology, the art of a historical and scientific study of the past, which has been largely due to the fact that by studying the past we can learn much about ourselves. This is particularly true of the study of the past in the Isle of Man, where the archaeological remains of the Viking period are particularly interesting. The purpose of this study is to provide a detailed account of the archaeological remains of the Viking period in the Isle of Man, and to discuss the implications of these remains for our understanding of the Viking period in general.

The archaeological remains of the Viking period in the Isle of Man are particularly interesting because they provide a unique insight into the lives of the Vikings in the Isle of Man. The archaeological remains of the Viking period in the Isle of Man are particularly interesting because they provide a unique insight into the lives of the Vikings in the Isle of Man. The archaeological remains of the Viking period in the Isle of Man are particularly interesting because they provide a unique insight into the lives of the Vikings in the Isle of Man.

12.2 Archaeological finds and methods

The archaeological finds of the Viking period in the Isle of Man are particularly interesting because they provide a unique insight into the lives of the Vikings in the Isle of Man. The archaeological finds of the Viking period in the Isle of Man are particularly interesting because they provide a unique insight into the lives of the Vikings in the Isle of Man.