Appendix A

Evidence for the Location of Leif Ericsson’s Vinland the Good
Being in the Western Gulf of St. Lawrence:
Conclusions From the Meteorological and Oceanographic Facts

by

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SUMMARY

The data of the Greenlanders’ Saga account of the voyage of Leif Ericsson to the land he named Vinland the Good in the years 1001-1002 A.D. have been subjected to meteorological and oceanographic analysis. The results indicate, first, that Leif, after leaving the storm-threatened Labrador shore in a hurry, probably sailed southwestward through the Strait of Belle Isle without landing on either its north or south coasts, and that he then entered the Gulf of St. Lawrence.

Second, he then continued to sail "before the northeaster and was out of sight of land for two days" before he sighted ‘an island’. This island was either Anticosti or Prince Edward Island, more likely the latter.

Third, the Vinland harbour where Leif wintered was probably a barachois-type harbour in the western Gulf of St. Lawrence on the Gulf shore of either Nova Scotia, New Brunswick or Quebec.

Introduction

The location of Leif Ericsson's country, Vinland the Good, and the harbour site where he settled and passed a winter in 1001-2 A.D. or so, have been the subject of many studies (1,2,3). The Greenlanders' Saga gives sketchy, although practical, details which up to now have yielded no definite circumstantial conclusions as to the location of Leif’s first encampment. As for actual archaeological evidence, the
only Norse settlement so far found in North America is at L’Anse aux Meadows on the south side of the entrance to the Strait of Belle Isle in northern Newfoundland (2). However, this settlement’s environment does not match the Saga's description of Leif’s Vinland as a land of mild winters with little or no frost, abundant forests, butternut trees and wild grapevines.

At first, the description of Leif’s voyage in the Saga is straightforward enough. The ship, or knorr, sailed from Greenland to Baffin Island, then south along the coast of Labrador, which Leif called Markland (i.e. forest land). On the Labrador coast, just south of Hamilton Inlet, is a 30 mile stretch of white sand beach. It was named Wonderstrands by Leif (Fig. 1). Here he landed to look at the timber and the country.

At this point the Saga poses what is the key problem to reconstructing the voyage geographically. The Saga says that, after inspecting the Wunderstrands beach, …

"They then hurried back to their ship. They sailed out to sea before a northeaster and were out of sight of land for 2 doegrs, (that is, for 2 sailing days) before sighting land. They sailed to this land and landed on an island in fine weather and looked around. The island lay to the northward of the mainland. They sailed westward into the sound (i.e. the strait) between the island and a cape that projected northward from the mainland."

A facile interpretation of the above facts is that Leif simply sailed on down the Labrador coast from the Wonderstrands with the stated northeast wind, landing in Newfoundland two days later at L'Anse aux Meadows on the Newfoundland coast at the entrance to the Strait of Belle Isle, the "island" mentioned in the saga being Belle Isle (2,3).

However, Farley Mowat, in his analysis of the voyage (1), points out that a northeast wind is directly on shore at the Wonderstrands, and so Leif could not have sailed ‘before the northeaster’ (i.e. southwestward) from there at all. Farley solves the problem by reasoning that Leif’s voyage was not via the Labrador coast but, instead, was direct
from Greenland: that is, that Leif had sailed southwestward out of Greenland for 5 days before a northeaster to land in Trinity Bay, Newfoundland at Tickle Cove Pond on the southeast coast. Mowat’s analysis correctly points out that the usual interpretation - which just ignores the northeast wind direction and the coastal orientation of Labrador to such a wind- is untenable. However, his own solution, in turn, requires altering the Saga's stated "2 days before the northeaster, (II doegrs) to 5 days (V doegrs); but, at least it does tackle the meteorological problem instead of just ignoring it.

The present analysis accepts the Saga as it is written. Leif and his crew were on the Wonderstrands beach when the Saga says that something came up to cause them to ‘hurry back to their ship’.. This interesting phrase is usually ignored, but it is at once understandable and seen to be very important- if we accept the Saga's next sentence about a northeaster. In such an on-shore wind, or even the threat of it, Leif and his crew would have quickly been in a dangerous situation at the harbourless Wonderstrands. With signs of a change in the weather, it would have been no place for a Norse knorr to linger, and we can thus understand the implications of the phrase, ‘they hurried back to their ship’. The important practical implications of this, to us, apparently trivial little detail, would have been quite clear to any medieval seafarer listening to a recitation of the Saga. With on-shore weather coming, Leif had to get a safe distance out to sea and away from a dangerous lee coast in a hurry.
Now let us look more closely at the meteorological situation implied in any ‘northeaster' in the Labrador-Gulf of St. Lawrence area. Such a wind would usually arise with the approach of a low pressure centre from the southwest, that is, from the Maritime Provinces area. In this synoptic weather situation (Figure 2), there would have been the approach of a low pressure center moving up the east coast, successively affecting the Maritimes, the Gulf, and then Newfoundland and Labrador. As the low moved up the coast, the wind at the Wonderstrands beach on the Labrador coast would have at first dropped to calm, and high cirrus clouds would have begun to appear on the southwestern horizon. This would have alerted Leif at once to the approach of bad weather, and he would have known that it was time to set sail and get some sea room between his ship and the coast, in preparation for the coming period of on-shore winds.

The initial period of light, increasing northeast winds typically lasts for several hours. This would have given Leif time to sail offshore 10 to 20 miles. He probably would have sailed just far enough off to still see the shape and trend of the shore as he coasted.
southward along it. Beyond the Wonderstrands, the Labrador coastline runs nearly southeast for about 65 nautical miles. Leif would have had to tack out to windward to get necessary sea room between his ship and that stormy coast in the onshore wind. About 65 miles or so along, the coast turns abruptly straight southward, and, with the strengthening northeast wind now more behind him, Leif would then have been able to pick up speed and still maintain a safe offing. Some 75 or 80 miles further south near Battle Harbour the coast turns southwest into the entrance of the Strait of Belle Isle (Fig. 1). To reach this point from the Wonderstrands, under the conditions postulated, would have taken Leif a day and a half or so. By this time the northeaster would have been full strength and big Atlantic swells would have been running into the Strait (Table 1). These big easterly swells would have been refracted shoreward in the shallower water along he coasts, and would have formed a line of onshore breakers on both the south and north coasts of the Strait. No mariner, not even one with full knowledge of the coasts - let alone Leif Ericsson feeling his way cautiously into unknown waters in a storm- would have ever approached the shores if it could have been avoided. Both coasts in the Strait would have been closed to landings both during, and for some days after any easterly storm. As the Gulf of St. Lawrence pilot [5, p.26] says:

"Landing.- After strong easterly winds, a heavy swell, lasting several days sets through the Strait and makes landing at most places on the Newfoundland coast impossible."

His total sailing time through the Strait would have depended on the state of the tide when he entered it. With an inflowing tide he could have passed through it in less than ten hours; with the reverse tide, it could have taken double that time.

Turning now to what Leif might actually have been able to see of the Strait in a northeaster; the visibility would have probably been pretty poor, with some rain and drizzle. Leif might never have even seen the south shore of the Strait at all, and might not have been aware of its existence, unless some reflected swells from its headlands gave him a faint clue. The only reasonable conclusion, given the statement of the Saga about the northeaster, and the known effects of the resulting state of the sea in the Strait, is that Leif never landed in the Strait, but continued on through it, running before the northeaster and trying to keep whatever safe contact with the mainland coast to the north that he could manage under the prevailing conditions of poor visibility and the state of the sea. At some point, he lost this contact with the north coast, and then ‘sailed before the northeaster for 2 doegrs (2 sailing days) out of sight of land’ [Fig. 1]

To sum up, our strict interpretation of the Saga is that Leif left the Wonderstrands beach in Labrador as soon as the wind shifted to light northeasterly. He then sailed down along the Labrador coast a safe distance off shore and into the Strait of Belle Isle. Here, the northeasterly storm had increased so that the coasts were closed to any landings, and so he sailed on through, keeping to the mainland or north coast. After the point where the Strait widens into the Gulf of St. Lawrence he lost contact with land for two days, still sailing before the northeaster. Then, when the weather had cleared, he was within sight of an island (Figs. 1,3) Some calculated wave heights for various strengths of northeast winds are given in Table 1 for reference.
Table 1
Wind Speed and Resulting Deep Water Wave Height

<table>
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<th>Waves</th>
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<th>Height and Period</th>
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<td></td>
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<td>18.2 kts (21 mph)</td>
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<td></td>
<td>Breeze</td>
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<tr>
<td></td>
<td>Strong Gale</td>
<td>30.4</td>
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Leif in the Gulf of St. Lawrence

The Saga says: "then they sailed out to sea before a northeast wind and were at sea two days before sighting land. They sailed towards it and came to an island which lay north of the mainland. Then they went ashore and looked around and the weather was fine. They saw that there was dew on the grass, and it came about that they got some of it on their hands and put it to their lips, and they thought that they had never before tasted anything so sweet. They then returned to their ship and sailed into the sound which lay between the island and the cape projecting north from the mainland. They sailed westward past the cape”.

Sailing before a northeast wind at around 6-7 knots for two sailing days would have put Leif 250 to 300 nautical miles into the Gulf. (Figure 1). Now, the islands in the Gulf of St.
Lawrence southwestward of the Strait of Belle Isle are Anticosti, Prince Edward Island, the Magdalen Islands and Cape Breton Island.

The latter, however, could hardly have been called an island by Leif, since it is separated from the mainland of Nova Scotia only by the narrow Gut of Canso and there is no evidence that he knew of this at all.

The Magdalens are small and very dangerous places it any storm. Even if the northeaster had ceased, there would still have been heavy seas breaking all around their shores, and he could never have landed on them. This leaves us with Anticosti and Prince Edward Island as candidates for Leif’s ‘island’. Anticosti lies south, not ‘north of the mainland’, as stated in the saga, and so we are left with P.E.I.

This landfall on P.E.I. fits well with the southwesterly course required for Leif running before a northeaster for two days in the Gulf (Fig. 1). It should be noted that Leif might also have had indications that P.E.I. lay ahead when he was still well out in the Gulf and before he actually sighted its shores, by observing the cumulus clouds forming over it in the fine weather behind the storm [7].

Thus we conclude that, sailing a course southwestward from Belle Isle, Leif would have sighted the Gulf coast of P.E.I. After a two or three day northeaster in the Gulf heavy northeast swells would still have been running and breaking all along the exposed north coast of the island even although the weather had cleared and the wind had shifted to northwesterly or westerly, as it typically does with the passage of a low. The coast would still have been unapproachable by any ship, and Leif would have had to coast eastward along the island’s north coast, keeping well offshore outside the breakers. He would have had a favorable off-shore wind with no fear of being forced to sail too near the shore; thus, sailing eastward along the Gulf coast of the island would have been the natural course to follow (Fig. 1).

Once past East Point on P.E.I. and running down the east end of the island, Leif would have been in shelter from the northeast swell of the Gulf. This east coast of P.E.I. would have been wide open for an approach and landing, somewhere between East Point and Murray Harbour. In fine weather, from a lookout on this coast, he would have been able to see across Northumberland Strait to the highlands of Nova Scotia to the east (i.e. in Cape Breton), while to the south he would have made out Cape George ‘projecting northward from the mainland' of N.S. He would also have seen that the island he was on ‘lay to the north of the mainland,' and that there was an entrance into the 'sound' (strait) running to the west.

He embarked and sailed over towards “the cape that projected northward from the mainland" and had a look at the coast. The cape - Cape George - is bold and precipitous, and so he "sailed westward past the cape" and "into the sound" (Northumberland Strait) (Fig.1)

Clearly, the above trajectory for the voyage, and the lay of the land given in the Saga, fit with a landing by Leif on eastern P.E.I. and then a continuance of his voyage westward into Northumberland Strait. There is no other area in the Gulf that corresponds so well to the
Saga account of Leif’s first landfall on this last leg of his voyage to Vinland harbour; this area is therefore a unique fit to the Sags description of Leif’s historic voyage.

WHERE DID LEIF LAND?

The Saga says:

"They then returned to their ship and sailed into the sound which lay between the island and the cape projecting northward from the mainland. They sailed westward past the cape. It was very shallow there at low tide. Their ship went aground, and it was a long way to look to the sea. But they were so impatient to get to land that they did not want to wait for the tide to rise under their ship but ran ashore at a place where a river flowed out of a lake.

As soon as the tide had refloated the ship they took their boat and rowed out to it, and brought the ship farther up the river and into the lake. There they cast anchor and carried their leather bags ashore and put up their shelters. They later decided to winter there and built large houses”.

Where was this harbour where Leif Ericsson landed? The Saga says only that he sailed "westward past the cape", and then, in the next sentence, describes a harbour entrance where ..... “It was very shallow there at low tide", where they went aground, and where there was an entrance or "river" into an inner tidal lake or lagoon. Typically, the Norse Saga wastes little time describing coastlines that were sailed past. It concentrates, instead, on listing very practical seafaring details which would help in locating the landing place or harbour.
The Characteristics of Leif’s Vinland Harbour.

Of course, the only final proof of Vinland’s actual location will have to be from archaeological evidence, if, indeed, any remains to be found. In the absence of any such, at this time, we must, instead, examine the circumstantial evidence of the Sagas, and subject that to critical analysis. So, what does the Saga say about Vinland the Good’s harbour?

The information supplied by the Saga fits the description of a typical barachois-type harbour. That is to say, a sheltered coastal lagoon or saltwater, tidal lake having a protective sand barrier or sand island across its entrance. There are many such barachois harbours in the western Gulf of St. Lawrence along the mainland coast from Nova Scotia north to the Gaspe. The entrance to the harbour which the Norse called a ‘river’, is often termed a ‘gully’ in the Atlantic Maritime Provinces. The inner tidal harbour, which the Norse called a ‘lake’, is still today sometimes called that, but is more usually called a harbour, lagoon or pond. Typically also, the seacoast right outside the barachois "river" entrance is shallow with sand bars. The Norse greatly prized these particular harbours, for, with their knorrs drawing only 3 or so feet of water, they could easily sail or ever row up the narrow entrance to find inside a completely sheltered harbour inside. Anyone who has inspected such harbours with a discerning eye, or any one who has ever passed a night in a barachois on the Gulf coast during a northeaster in a small craft, and heard the roar of the surf across the protective sand barrier only a couple of hundred yards away, all the while riding safely and snugly at anchor in the inner harbour, will appreciate the Norse preference for them. Thus, we must look for Leif’s harbour in a "barachois" in the western Gulf of St. Lawrence coastline, either in Northumberland Strait or further north along the New Brunswick coast toward Gaspe, Quebec.
The simplest interpretation of the Saga would be that Leif sailed past Cape George and landed on the coast immediately to the west of it, say near Pictou, N.S. However, Leif, in calling the passage he had just entered a sound or strait, must have either sailed right through it or else have explored it later to establish that it had an exit and did not simply end in a bay, otherwise he would have called it a bay or fjord. Indeed, Jacques Cartier did just that in 1535 when he entered the Strait from the western end at North Cape, P.E.I. and sailed southward into Egmont Bay. There he crossed over to Richibucto Cape on the New Brunswick mainland, apparently decided that he was in a bay, and turned back north along the coast to Miramichi Bay and then on northward to Baie des Chaleurs. Leif on the present reading, sailed far enough through Northumberland Strait at some time to correctly determine its true nature as a strait.

There is another aspect to this matter. Leif, as a practical, wise and prudent commander, certainly always had on his mind, not only discovery and exploration of a new land, but also the ever-present necessity of attention to the return voyage to Greenland. To that end, whenever he entered unknown waters, he needed to know how to retrace his path. Thus, in sailing westward into the Strait past Cape George, he needed to find out for certain if, on a return home, he would have to retrace his path to sail out of there, or if the waterway was also open to the sea at the other end, so that when the time for the return voyage to Greenland arose, he could sail through it and have a clear path back northeastward across the Gulf toward the Strait of Belle Isle from whence he had come.. On the present reading he went at least far enough through Northumberland Strait to be certain that it was really a strait open to the Gulf at its western end. This would have to be as far along the Strait as Richibucto Cape and Kouchibouguac Bay..

The Saga, in addition to almost certainly describing a barachois harbour, adds the following details about it and the surrounding country for our analysis:

a) There were plenty of large salmon in the lagoon and its entrance.

b) There was plenty of fodder for the cattle they had brought along for the voyage.

c) There were fields of "wild wheat".

d) They found plenty of timber for shipbuilding. The trees which they prized and which they cut to take home may have been a species of birch (called 'masur' in the Eric the Red Saga)"

e) There were wild vines and grapes. (The vines were of great use to the Norse' because they needed them for shipbuilding, and there were none in Greenland).

f) There was no frost in winter and the grass hardly withered.

g) There is a reference in the Saga to a determination of the latitude of Vinland the Good via the length of daylight on Dec. 21st. Unfortunately, this latitude reference can be interpreted as being anywhere from 40 deg. to 50 deg. north, which corresponds to anywhere from the entrance to Northumberland Strait at Cape George on the Nova Scotian coast to the North Shore of the St. Lawrence River in Quebec.
The Saga concludes;

“A full cargo was cut for the ship, and in the spring they made ready and sailed away. Leif gave the country a name in accordance with its resources and called it Vinland (for Wineland. They then sailed out to sea and had a good wind until they sighted Greenland and the mountains below its glaciers.”.

The above details are all from the Greenlanders' Saga. A second Saga, called Eric the Red's Saga, is very much shorter, giving no details on Leif’s voyage except to say that he set out from Norway, not from Greenland via Markland (Labrador),... missed his way to Greenland in a storm, and instead found Vinland. The Saga text reads as follows:

“Leif put out to sea, but he (was) driven by storms for a long time, and he found a land whose existence he had never suspected. There were fields of wheat growing wild and there were vines as well. There were also those trees which are called masur and of all these things they took samples. Some of the trees were so big that they were used for house building”.

The above is all that we know of Vinland from the Sagas. Items a) b) c) d) and e) relate to the fauna and flora of Leif’s Vinland harbour, and are ultimately matters for biological and botanical expertise (9,10,11) to evaluate.

Item (f) calls for a detailed evaluation of the climatology of the western Gulf mainland with attention to such questions as: What did ‘no frost’ mean to the Greenlanders? What weather were the Norse used to in Greenland as their standard of comparison? What adjustment should be made in using the modern climatological data in the Gulf area to allow for the milder weather in 1002 A.D. caused by the Climatic Optimum which then prevailed? What extreme values of the climatological parameters can reasonably be assumed? Is there a role for a 1002 A.D. occurrence of the El Nino phenomenon? etc..(12).

Finally, we should mention that in the two Sagas there is a wealth of detail on several other later voyages from Greenland to Vinland, especially on the major colonizing voyage by Thorfinn Karlsefni with several ships and possibly up to 200 men and women. These, voyages made within ten years or so after Leif’s pioneering one, must be considered in any attempted circumstantial location of Leif’s harbour (13).

CONCLUSION

If we accept the Greenlanders' Saga account of Leif’s Voyage as it is written, we are led, on meteorological and oceanographic grounds, to conclude that he probably sailed southwest through the Strait of Belle Isle and on into the Gulf of St. Lawrence, where, after two "sailing days", he sighted Prince Edward Island on which he landed. He then
sailed westward into Northumberland Strait past the coasts of Nova Scotia and New Brunswick. His landing on the mainland coast was probably at a barachois harbour somewhere between Cape George, N.S. and the coast of the Gaspe Peninsula in Quebec.

The circumstantial evidence from the Sagas as to a more precise location of Leif’s Vinland Harbour will be analyzed in Part 2 of this study. (i.e. in Appendix B)

REFERENCES AND NOTES


4) There is another possible meteorological situation which could have set up the ‘northeaster’, described in the Saga. It is much less common than the low pressure centre over the Maritimes described in the text. In the end it gives the same conclusions as to Leif’s trajectory. In this synoptic situation, a cold front moves down the Labrador coast from the north. High pressure cell behind the front builds rapidly and the wind shifts to northeasterly soon after the cold frontal passage. At the Wonderstrands the front would have been preceded by fine weather and southwesterly, i.e. offshore winds. The frontal passage at the beach would have typically been quite sudden with a narrow band of cloud moving down from the north accompanied by a sudden shift of the wind to northwest or north. This change in weather would have alerted Leif to hurry out to sea and get well away from the beach area. Once he was well down the coast into the Strait of Belle Isle, the wind would have been solidly in the northeast and the situation would have been the same as in the case described in the text. Again, the resulting easterly swells would have made either coast dangerous or impossible to approach and he would have coasted along the north shore of the Strait of Belle Isle and right on into the Gulf.


6) Ingstad (2) takes a doegr (or sailing day) as equivalent to 150 nautical miles, based on an average sailing speed for a knorr of 6 knots. Mowat (1) takes the average speed at 5 knots and gets 120 n. mi. as the equivalent distance. A modern day replica of a Norse ”knorr” has logged a speed of 11 kts. under favorable conditions (2).

7. Leif may well have had indications of a landfall ahead when he was still out of sight of land by sighting the cumulus clouds which build up over the Island in fine summer weather, and which could have been seen out in the Gulf while he was still as much as 75-100 miles (125- 160km) at sea. The coastline of P.E.I, which is only 50 to 200 feet in height (15 to 60 m.), would be visible for 10 to 20 miles (16 to 32 km) offshore.
8) Farley Mowat in his book (1) has an excellent account of these barachois harbours and of their importance to Norse ships. The knorrs were shallow draft vessels, typically drawing only 3 feet or so of water, and they were often beached on suitable sandy, sheltered shores. The Norse called such a barachois harbour, having an outer, barrier island and an inner, sheltered lake or lagoon, a "hop" (pronounced like 'hope').

9) Almost any river flowing into the Gulf would have had salmon in abundance in those times. Most still have some today. It may be worth looking into the Saga's mention of the large size of the salmon that Leif found, since there are still noticeable differences between the various Gulf rivers even today as to the size of the salmon that run into them, some rivers having much larger fish than others nearby.

10) The "self-sown wheat", or wild wheat, is generally considered to be Sea Lime Grass. It is variously called Lyme grass, Sea-Lyme grass, wild sand wheat, Siegle de mer, Elymus arenarius L. (Frere Marie-Victorin, Flore Laurentien, Presse U. de Montreal, 1965. pp786-787 says: "Il est clair que " E. arenarius est le "Ble" dont parler les relations de nos decouvreurs (Jacques Cartier, etc.)". Also, Morison (3, p. 52) credits Meritt L. Fernald of Harvard with identifying this "self-sown wheat" with Lyme grass, a long wild grass with a wheat-like head which grows along beaches from Iceland to southern New England. He cites abundant evidence for the seeds of this plant, in recent times, having been used to make flour and bread in Iceland, where it was popularly called vilde hvede (wild wheat) or sandhavre (sand oat). As far back as 1749 Peter Kahn, the Scandinavian botanist and explorer, wrote of the north shore of the St. Lawrence, west of Murray Bay, "The sand-wheat was abundant on the strands". It is worth noting that because this grass has a southern limit on the New Hampshire coast, it favours a more northerly location for Vinland itself.

11) In many ways the problem raised by the mention of the occurrence of wild grapes in Vinland is opposite to that of the wild wheat. Many commentators, noting that the American wild grape Vitis labrusca (Fox grape,) has a northern limit of southern N.S. and extreme southwestern N.8., argued that Vinland must have been on the New England coast or even south of that. However, the Riverbank grape, wild grape, raisin sauvage, vignes des rivages, frost-grape, Vitis riparia Michaux. is well distributed in Nova Scotia, New Brunswick and southern Quebec. It is considered by Marie Victorin (Flore Laurentien) that it was certainly the wild grapevine of Jacques Cartier who reported it as growing abundantly on Isle d'Orleans in the St. Lawrence River just below Quebec City in 1535. A precise northern limit for this wild grape along the shores of the Gulf coast could therefore be important for a better identification of Leif Ericsson's Vinland the Good Harbour. The raisin sauvage certainly grows abundantly along the St. Lawrence at Montreal. At Montreal the actual grapes are not abundant, but the vines grow to impressive lengths, often covering a supporting tree to a height of 30 feet or more. Farley Mowatt also cites evidence that this plant was once abundant in southern Newfoundland in the 17th century.

12) "There was no frost and the grass hardly withered in winter". This is perhaps the most difficult of all the conditions set out in the Saga's description of Leif's Vinland Harbour to be met for taking it's location as being in the western Gulf of St. Lawrence. There, the harbours ordinarily now freeze over in December, and are ice-covered till early April.
However, occasional very mild winters do occur there, especially in the southern Gulf, giving a "green Christmas" with little or no snow even in January and February, and much rain and thawing.

Exactly what the term ‘no frost’ actually meant to the Norse, who had no thermometers, is important. They expressed little interest in anything other than the very practical details which affected their vital needs. It may have meant only an "open winter" to them, one with not enough ice to bother them in their work of cutting and floating logs around, and fishing from their longboats in the harbour. A winter in which they could work outdoors easily, and especially one with little solid sea ice or harbour ice would certainly have impressed them as being "open". They were impressed, for example, that "the grass hardly withered", since this meant that the cattle which they had brought with them could graze outdoors without the need for shelter or supplementary hay.

In Part 2 of this study (Appendix B) an examination of the climatic variations in those Gulf areas of interest will be undertaken in an attempt to better quantify this ‘mild winter effect’, and to establish definite probabilities for its occurrence in the area.

The probabilities for the occurrence of "open winters" in modern times can then be adjusted rationally to any given value assumed for the milder weather period that may have occurred around 1000 A.D. It should perhaps be noted here that the L'Anse aux Meadows Norse site on the Strait of Belle Isle is much colder in winter than sites in the western Gulf south of Gaspe.

13) Leif himself named the whole country he had discovered Vinland the Good, not just the harbour where he first settled. Following Leif, perhaps we also should consider Vinland, or ‘Vinlandia’ as not being just his landing site, but rather as encompassing the entire Gulf of St. Lawrence (Fig.1). On this interpretation of the Sagas, L'Anse aux Meadows on Promontorium Vinlandia, as the area is named on some ancient maps, would be a main base settlement at the entrance to Vinlandia.