

Ladies and gentlemen. You will perhaps find that I have given this paper of mine a somewhat pretentious, not to say arrogant title. I have of course only very briefly dealt with some of the problems we are confronted with. For natural reasons Icelandic archaeology is not a very fertile field and never will be. In this country we have hardly any prehistory at all. Our great inheritance is the brilliant mediaeval literature, the investigation of which, of course, is the natural and most tempting field for Icelandic scholars and foreign students of old Icelandic culture. This fact, however, is no reason why we should neglect such archaeological remains as there are in this country. Here, as everywhere else, they tell their own story and in their own way, and are entitled to a deserving place among the things which can throw light upon our old history and culture. I therefore thought it natural to give, especially to our overseas guests, some sort of a general survey of these matters at the beginning of this Viking congress. I also thought it might be an appropriate introduction to our museum, to which we shall now have the honour of conducting you.

## Stature as a criterion of the nutritional level of Viking Age Icelanders

*By Jón Steffensen.*

Iceland was settled in the upheaval of the Viking Age by vikings who came mainly from Norway and the British Isles. For those who take interest in vikings the Icelanders, therefore, have particular significance, and even more so in view of the fact that they have lived in isolation on an island. There has consequently been little admixture of foreign blood since the Viking Age.

My time would not permit me to deal adequately with the physical anthropology of the nation as a whole, so I have had to narrow my scope and confine my discussion to the stature of the population.

The reason why I chose stature was that it will give us a better idea than all other anthropological characters of the living standards of the nation in past centuries. It will indicate how the Icelandic branch of the vikings fared in their new country.

The material on which I have based my study is on the one hand bone finds from various parts of the country dating from many different periods, and on the other measurements of Icelanders carried out in the 20th century.

I have classified the bone finds in accordance with the age and location of each find. The oldest material consists of bones dating from the pre-Christian period, i.e. from the years 874—1000, but a large majority of them date from the tenth century. They come from 86 individuals in all, distributed between the different parts of the country as follows: from the South-West there are eight, from the North-West peninsula two, from the North forty-four, from the East fifteen, and from the South seventeen. Only about half of this skeletal material, however, has been preserved well enough for use in calculations of stature.

The samples which come next in age consist of bones from the churchyard at Skeljastaðir in Þjórsárdalur in the South. They date

from the early Christian period, presumably all from the eleventh century, the latest possible date being 1104, when Mt. Hekla erupted for the first time on record. The bones are in excellent condition; there are fifty-five almost complete skeletons of adults.

The third group contains bones from the churchyard at Haffjarðarey in the South-West. It is known that the church was disused in 1563 and that its oldest records date from the year 1223. It is therefore pretty safe to assume that a church was built at Haffjarðarey soon after the introduction of Christianity. The bones are in excellent condition, but the skeletons of adults number only seventeen, whereas there are thirty-seven skeletons of adolescents and children.

I have put finds from several different localities into a separate group. They contain skeletons of thirty-nine adults and thirteen children, which cannot be dated with any degree of certainty. Some of them come from places where, according to old records, chapels were located, but we do not know when they fell into disuse. Undoubtedly most of these graveyards date from the Catholic era or hardly later than from 1600. Others come from burial grounds of which we have no records, some of them probably from the early Christian era or possibly from an earlier date, because some of the settlers are known to have been Christian. The skeletons were found in various parts of the country, their distribution being in detail as follows: three come from the South-West, thirteen from the South, three from the East, and thirty-three from the North of Iceland.

Forty skeletons have been unearthed from the foundation of the last Skálholt Cathedral. They unquestionably date from the period 1650—1796, but they are in a rather bad condition. Only just over half of them could be used for the purpose of this study.

Finally there are bones from eight skeletons of adults from a Reykjavík churchyard which was disused in 1850. These bones have been preserved in an excellent condition and apparently date from the 18th century to judge from the coffins in which they were found.

The whole material is from just over 300 individuals, but only about half of them are skeletons of adults preserved well enough for the purpose of determining their stature.

The South-West, the South and the North of Iceland are well represented with well preserved skeletons, the East of Iceland rather badly and the North-West peninsula not at all.

Taken together these bone finds suggest that the population of the country was more or less homogeneous, and when we except variations in stature and head size we may say that the physical characters of the nation have not undergone any changes that would suggest admixture of foreign blood. I want my listeners to bear this in mind, because it is of primary importance for the conclusions I draw from my study of stature later in this lecture.

As a basis for my calculations of stature I used the Tables of Trotter and Gleser (1952), using the length of the femur and tibia when both these bones were available, of the femur alone if the tibia was missing, of the tibia and one of the long arm bones if the femur was missing, and when only one long limb bone was available, whichever of them it was, I used it for my purpose. The reason why I have always, if possible, used the femur or any other long limb bone in conjunction with the tibia in my calculations is that the tibia is unusually short in Icelanders, proportionately much shorter than in Americans, who form the basis of the Tables I used. Consequently it may be assumed that the stature would be too high if the tibia was not included, and conversely it would be too short if the tibia was used alone. On the whole it may be said that the Tables of Trotter and Gleser give 3—4 cm higher stature than the Tables of Manouvrier and Pearson's formulae, which have been most widely used up to now, but for reasons given by Trotter and Gleser, which I accept as valid, I believe their Tables give more accurate results.

Table I. *Estimated maximum stature from long bones of Icelanders.*

Group	Date	No.	Male Mean stature	Female Mean stature	$\delta + \varphi$ Calculated as $\delta$	
					No.	Mean stature
Pre-Christian	874—1000	22	172.3	17	39	173.2
Skeljastaðir	1000—1100	27	172.0	28	55	171.8
Haffjarðarey	ca.1100—1563	6	175.2	11	17	172.0
Various Places	ca.1000—ca.1600	16	171.0	10	26	171.5
	874—ca.1600	71	172.2 $\pm$ .59	66	137	172.2
Skálholt	ca.1650—1796	17	169.7	6	23	168.6
Reykjavík	18. century	4	167.0	3	7	166.8
	1650—1800	21	169.2 $\pm$ .93	9	30	168.2

The result of my calculations can be seen in Table I. When we look at the samples dating prior to the year 1600 we can see that

the male stature varies from 171 to 175.2 cm, and the female stature from 157.3 to 161.2 cm. It should be noted that the tallest or shortest men do not occur in the same group as the tallest or shortest women. In fact, the opposite is often true. The tallest men and the shortest women, for instance, were found together at Haffjarð-arey. Taking this into consideration as well as the fact that there are so few skeletons in each group we may safely assume that there is hardly a statistically significant difference in stature between the populations that our samples represent.

In order to facilitate the comparison between the groups I have converted the female stature to the corresponding male stature by dividing the female stature by the sex index of stature. The index was computed from the average of all groups dating prior to the year 1600, and proved to be 0.925, coming to exactly the same ratio as there is between the heights of men and women in this country today. The figures for the mean male stature calculated from the heights of both men and women are in the back column, and you will see there that the statures are almost the same in the three groups from the Christian period, i.e. 171.5 to 172 cm, but in the group from the pre-Christian period the stature is somewhat higher, or 173.2. Its difference from the samples under Various Places, which show lowest stature, is not statistically significant, however. Besides, the population represented by this group were no doubt commoners, whereas the samples from the pre-Christian period presumably represent mainly chieftains. In so far as we can draw any conclusions from such scanty material, stature seems to have remained more or less constant from the days of the settlement down to the 16th century and has probably been more or less the same all over the country, at least in the North, South and South-West.

Turning to the 17th and 18th century groups we can see that their statures are a good deal smaller than those of the samples that date prior to the year 1600, even though we are fully justified in assuming that the stature of the Skálholt people was higher than the mean stature of the population, because on the whole they belonged to the upper class. Among them there are, for instance, no less than 4 bishops and 4 bishops' wives. It is particularly noticeable how the women of this group are small of stature, but it may well be a coincidence resulting from the small number of samples.

From my study it is hard to be sure of what the mean stature of the Icelanders really was during these two centuries with so

scanty material to go by and because the Skálholt material was selected, but if men and women of both groups are taken together and the mean male stature is calculated from the heights of these 30 individuals the result is 168.2 cm. According to the measurements of G. Hannesson in 1920—23 the mean stature of students and university graduates proved to be 174.7, but of sailors and farmers 173.3 cm. If we assume a similar difference between the statures of the members of these social classes in the 17th and 18th centuries the mean male stature should have been about 167 cm.

Table II. Stature measurements of living Icelanders.

Date	Age	No.	Male Mean stature	No.	Female Mean stature	Sex index ♀/♂	Author
1910—1914	20—48	383	172.84				D. Sch. Thorsteinsson, P. Jónsson, H. Ribbing
1920—1923	20—40	844	173.55				G. Hannesson
1946	19—60	1001	175.88	1000	162.45	.924	J. Steffensen
1952—1954	20—40	1166	176.8	464	163.7	.926	Jens Pálsson
1952—1954	20—22	297	178.0				Jens Pálsson

In Table II I have arranged measurements of the stature of Icelanders in the 20th century. The first measurements are from the years 1910—14, giving the mean male stature as 172.84 cm. When the next measurements were carried out in 1920—23 the male stature had reached 173.5 cm, and the most recent measurements in 1952—54 give it as 176.8 cm, and to judge from the heights of 20—22 year old males we may expect it to have reached 178 cm within the next few years. These figures, however, are perhaps slightly higher than the real mean stature of the population each time, because the material on which they were based did not represent an accurate ratio between the social classes. The professions and white collar workers have probably constituted a proportionately larger part of the samples than general workers, farmers and sailors. This is least true of the last measurements, however. Moreover, the average age of the samples is not the same in all the groups. This has a particular reference to the measurements carried out in 1946, but the age matters a great deal when the stature of living people is measured, because after the age of 30 the average height drops about 0.06 cm a year, and maximum height is not reached until the age of 20—25 according to the rate of growth. However, this

does not affect the measurements of the long bones of the limbs. Their length does not change after the epiphyseal lines are closed, and when they are used for the calculations of stature the results represent maximum stature, i.e. the height of the years from the time when the growth has come to an end to the age of about 30. For these reasons the calculations of stature in Table I are not altogether comparable to those in Table II, where only part of the samples are of the age when stature is at its maximum. The difference between the statures of the present and the past is therefore somewhat greater than what the figures in these Tables indicate, but the discrepancy must be only slight except possibly in the 1946 group.

With these shortcomings of the methods in mind I wish to summarize in a few words the conclusions to be drawn from these two Tables:

From the age of the settlement down to the 16th century stature remained more or less constant, or about 172 cm. In the 18th century it fell to 167 cm, and about the middle of the 20th century it rose to 176.8 cm. In other words in a period lasting 400 years at the outside, or in the course of 16 generations, the mean stature of the population first falls about 5 cm and then it rises 10 cm again, a variation of 1 cm a generation on the average.

What is the reason for these rapid and extensive variations in stature? With our present knowledge of genetic laws we cannot relate these phenomena to any of them, not least because the direction of these changes has reversed in this short period. In my view it is out of the question to relate these variations to changes in the genetic composition of the population.

On the other hand it is possible to point to environmental influences which might have caused changes in stature. I am first and foremost referring to the quantity and quality of the diet, which plays an important part in the growth of people as well as animals and is, moreover, one of the most effective limiting factor on the size of populations.

Direct information about the quantitative aspects of the diet of the Icelanders at any given time in the past does not exist, but the number of years when famine harassed the people, as well as the size of the population at any given time, give indirect information on the subject.

P. Thoroddsen has in his book *Árferði á Íslandi* published

the number of years in each century in which, according to contemporary annals, people died from starvation, but it should be noted that before 1600 all records are much scantier than after that time. This is in particular true of the 15th century. The figures for the years before 1600 have to be viewed in the light of this fact, but all the same I believe they give some information about the ability of the population to obtain food in those times. After 1600 we may say the records are adequate.

The first reliable census was taken in 1703 and after 1735 we have pretty reliable records on the size of the population each year. For the years before 1703 we have nothing but more or less reliable estimates of the size of the population. I shall not go in any detail into the estimates which relate to the years 965, 1095 and 1311, but wish to refer my listeners to a paper by Professor Ó. Lárusson which appeared in *Nordisk Kultur*. I would just like to point out that there have been two schools of thought with regard to the size of the population of Iceland during the first three or four centuries of its history. One view is that the population reached its maximum size round about the year 1100 when those who reach the highest estimate think it exceeded 100.000. The other view is that the population in this early period was never much larger than what it was in 1703, or just over 50.000. I believe this latter estimate is too low, because I think there are weighty arguments for the view that already in the late 17th century the population exceeded 50.000 to a considerable extent. I shall now attempt to produce these arguments, as it has not been done before elsewhere.

When the census of 1703 was taken the country had just gone through a series of famine years, or all the years from 1696—1701. It is not known how many people perished, but if the description in the Annals of these years is compared with their description of the famine in the years of 1752—59, during which the fall in the size of the population was 6224, it cannot be seen that the decline was any smaller in the earlier period.

Another indirect source on the decrease in the size of the population during the years of 1696—1701 is the Estate Record of Árni Magnússon and Páll Vídalín which was written in 1702—1714. I have counted the farms and tenancies which are stated in the Record to have been built for the first time, or re-occupied, in the 17th century before 1696 and I have also counted those which were abandoned at the same time. The new farms proved to be 201 in

excess of those which had been evacuated. Further, I have counted those which were abandoned in the years 1696—1702. They proved to be 336 or 135 more than all the increase before the year 1696. After the famine of 1784 the fall in the size of the population in the Northern bishopric of Hólar was 3327 people, and 315 farms were abandoned at that time. Proportionately the fall in the size of the population in 1696—1702 should have been about 3400. Finally I have taken the parishes and districts where the farm census was taken after the Small Pox of 1707, comparing the number of the farms which were abandoned in 1696—1702 with the number of those which were evacuated after the Small Pox, but then it is estimated that sixteen to twenty thousand people died. Approximately two thirds as many farms were abandoned in 1696—1702 as there were after the Small Pox.

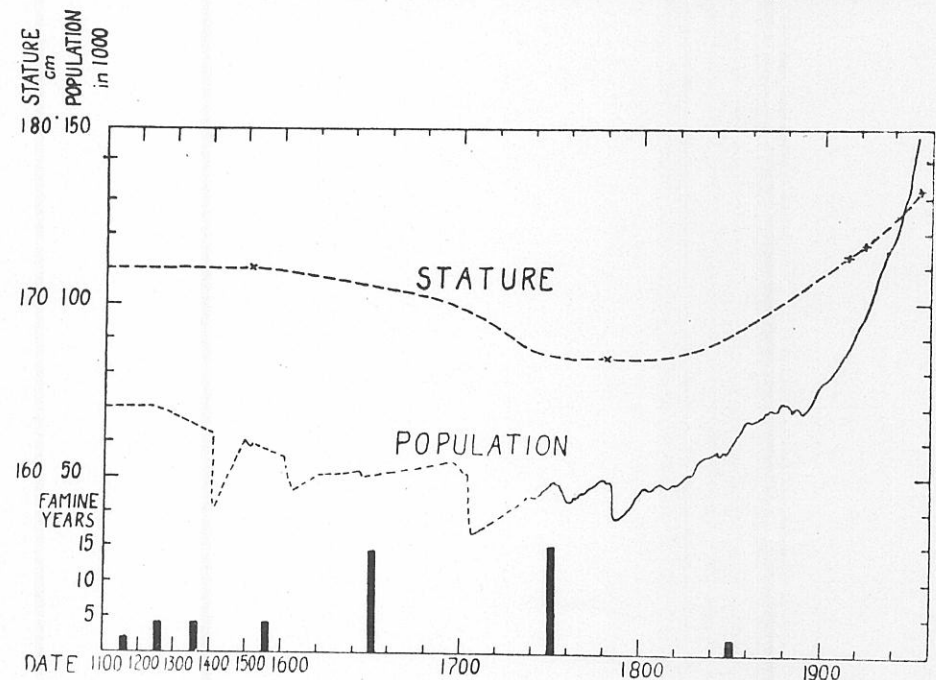
I am not going into this matter any further here, or into the shortcomings of these sources, but I think there is no doubt that the maximum population of this country in the 17th century was considerably above 50,000. I believe the size of the population in 1695 was on no account under 54,000, but before that time it seems to have been on the increase to judge from the rise in the number of farms during those years. I have estimated that the population in the 17th century was at its lowest 46,000 after the famine of 1602—04, when, according to contemporary annals, 9000 people died from starvation. In 1600 the population should accordingly have been about 55,000. Thus I believe that there were on the average several thousand more people in Iceland in the 17th century than in the 18th.

In view of the size of the population in the seventeenth century and the fact that the country itself was undergoing a process of deterioration I believe the population was a good deal larger during the first centuries of its history. We find the same process in Iceland as in other countries in which man has settled that he has gradually left the soil behind him wasted and eroded. Besides the deteriorating climate has contributed to this process. The descriptions in the Estate Record indicate that the glaciers on the North-West peninsula and in the South-East were growing larger. When they began to advance cannot be determined for certain, but from what Árni Magnússon writes in *Chorographia Islandica* (Levned og Skrifter, II, pp. 255—278) and from what may be surmised from hints in the church inventory at Möðrudalur of 1575<sup>1)</sup> we may

<sup>1)</sup> D. I. XV, 674.

assume that they did so in the 16th century. When the geographical survey of East-Skaftafellssýsla was made by the Danish Chiefs of Staff in 1905 Vatnajökull, our largest glacier, had evidently shrunk, and since then all the glaciers have been retreating.

I therefore tend to agree with those who believe that the population of Iceland during the early centuries of its history reached



its highest peak in the 12th century, considering 70,000 to be a likely figure for that period.

For illustration I have made a chart showing the number of famine years, the size of population and the mean male stature of each century. The bars at the bottom of the chart show the number of famine years a century. Their number is largest in the 17th and 18th centuries, or 14 and 15 years respectively and drop down to 2 in the 19th century, but are 2—4 a century before 1700. As I mentioned before they may very well have been more frequent during this early period, but I do not think they were much more so as far as the 16th century is concerned, and I think it is highly im-

probable that they ever reached anything like the proportions of the 17th and 18th centuries.

The top curve represents stature and the bottom one the population. The portions of the population curve depicted by a continuous line represent the known facts, but the portions drawn in broken lines are more or less hypothetical. The continuous line of the population curve in the 18th century undergoes great fluctuations, but they are reduced in the 19th century and disappear altogether after 1890. From then onwards the line undergoes a steady rise. For the years before 1700 one must assume fluctuations similar to those of the 18th and 19th centuries, although I have not indicated these fluctuations in the curve.

It is needless to remind you that only a portion of the fluctuations was due to famine. Many of them were caused by pestilences, but often it is hard to judge from the entries in the annals whether the famine or the pestilences played a greater part, and it is well known that there are various diseases caused by malnutrition.

The bars for the famine years and the population curve show that the people have starved in the 17th, 18th and in the early 19th centuries, and I believe this was the principal cause of the small stature of the population during these years. A contributory cause was probably the hard toil to which children and adolescents were subjected while they were still growing, as it reduces the food available for growth, whereas nowadays youngsters work only in moderation.

The question which now confronts us is: To what extent can environmental influences affect the mean stature of the Icelandic population? With a direct reference to this question I will endeavour to answer another question first: What is the possible minimum mean stature for the survival of the Icelandic population? From historical records it is evident that during the second half of the 18th century the Icelandic population suffered so much want that its survival was in danger. It seems likely, therefore, that the mean stature of the population must not go much below 167 cm if survival is to be ensured.

The settlements of Icelanders in Greenland can give some information on this subject. In Table III I have put the results of my calculations of their mean stature using the methods of Trotter and Gleser as before. Even though the groups are small, except the one from the West Settlement, they all point to the same conclusion, i. e.

Table III. *Estimated maximum stature from long bones of Greenlanders.*

Group	Date	Male		Female		$\delta + \varphi$ Calculated as $\delta$		Author
		No.	Mean stature	No.	Mean stature	No.	Mean stature	
Garðar	ca.1150—1200	3	ca.168.	1	161.8	4	ca.169.7	K. Bröste & Fischer-Möller
W.-Settlem.	1275—1350	7	165.9	26	157.2	33	169.1	K. Fischer-Möller
Herjólfssnes	ca.1400	3	ca.164.6	6	ca.151.3	9	ca.164.0	F.C.C. Hansen

that the stature of the old Greenlanders was considerably lower than that of the contemporary Icelanders. Moreover, they show a tendency to a lowering stature as time went on and round about 1400 the mean male stature was only 164 cm. From then onwards it is supposed that the Icelanders died out in Greenland, but we have no reliable sources to inform us exactly how and when it happened, but it was probably not later than the 16th century and the cause was most likely difficulties in obtaining sufficient food-stuffs. Whether some of their blood flowed into the Eskimo population remains an open question, but there are no positive indications to that effect, notably not in skeletal finds, which would, however, be most likely to give a positive answer.

But this is not all-important in this connection. The important thing is that the Icelandic population became extinct as such in Greenland, because the struggle for existence proved too hard. Whether some of their blood may run in the veins of the Eskimos is beside the point, because they are a different race with a culture of their own. The Eskimos could survive under Greenlandic conditions and have the honour of maintaining life there.

It is another question whether the nine badly preserved skeletons from Herjólfssnes give a true picture of the stature of its population round about 1400. Only further skeletal finds from the last period of the Icelandic settlements in Greenland can give a satisfactory answer to this question. Their mean male stature, 164 cm, may appear a bit too high for the conclusion that the Icelandic population had then lost all its power of resistance, even though it is tall by nature, considering that in 1840 the mean stature of Swedish conscripts was 165 cm, but the Swedes are also tall by nature. These two figures are not comparable, however, because as I have

mentioned before the stature calculated from the length of the limb bones represents the maximum stature of the individual, whereas the measurements of conscripts do not. This is in particular true of early measurements of stature, because in the 18th and 19th centuries when stature was lower than it is now the rate of growth was also slower. Consequently it is certain that the figure 165 cm is at least 1 cm below the mean stature of the Swedes in 1840. All things considered and in view of the stature of Icelanders in the 18th century I think it may be quite possible that 164 cm is the minimum mean male stature of the Icelandic population.

As for the maximum mean stature of Icelanders we can only say that the highest mean stature obtained so far is 176.8 cm and it is likely that it will become as high as 178 cm in the next few years. Neither of these figures would represent maximum stature as the reconstruction of the long limb bones does. Moreover, it is well known that during the last 10—15 years all the Icelandic population has had abundance of food, and children and adolescents have not had to work too hard. It is therefore quite possible that when the people who are now children and adolescents have reached their maximum height the mean male stature will prove as high as 180 cm. I think that a still higher average is rather unlikely, but it will be safest not to prophesy anything in this respect while we do not know more about physical growth than we do at present.

My answer to the question as to what effect environmental influences can have on the mean stature of the Icelandic population is then that they can at least cause a variation of 14 cm. This is a large range considering that the difference between the mean stature of pygmy races in Africa and the very tallest populations is about 40 cm.

This finding urges increased caution in drawing conclusions about the racial differences of two populations based on their difference in stature alone even if it is anything up to 14 cm as long as their relative living standards are not known. If a difference in stature is the only thing that might suggest a different genetic composition in two populations it is more often likely to be due to dietary than to racial differences.

Finally I believe anthropologists and archaeologists could more profitably use stature as a criterion for the living standards of pre-historic populations than they have done so far.

As far as the vikings who settled in this country are concerned I consider they were in no worse position in way of food than the Icelanders at the beginning of the 20th century.

## REFERENCES

- Trotter, M. and Gleser, G. C. (1952): Estimation of stature from long bones of American Whites and Negroes. *Am. J. Phys. Anthropol.*, M.S., 10: 463—514.
- Hannesson, G. 1925. *Körpermasze und Körperproportionen der Isländer*. 254 pp. Reykjavík, Árbók Háskóla Íslands.
- Steffensen, J. 1950. Um líkamsstærð Íslendinga og orsakir til breytinga á henni. *Læknablaðið*, 34: 127—148.
- Pálsson, J. Personal communication.
- Thoroddsen, Þ. 1916—17. *Árferði á Íslandi í þúsund ár*. 432 pp. Kaupmannahöfn.
- Lárusson, Ó. *Befolkning i Oldtiden*, 5. Island, *Nordisk Kultur I*: 121—137. København.
- Bröste, K. and Fischer-Möller, K. 1944. *The mediaeval Norsemen at Gardar*. *Meddelelser om Grönland Bd. 89, Nr. 3*, København.
- Fischer-Möller, K. 1942. *The mediaeval Norse settlement in Greenland*. *Meddelelser om Grönland, Bd. 89, Nr. 2*, København.
- Hansen, Fr. C. C. 1924. *Anthropologia medico-historica Groenlandiæ antiquæ. I. Herjólfssnes*. *Meddelelser om Grönland, Bd. 67, Nr. 3*, København.

ing of the element is obviously "shieling, hill pasture," or so. The Irish form of the corresponding word is *airghe*, the Scottish *àirigh*. See my article in NAMN OCH BYGD 1956, pages 51 to 67, where the paper read at the Viking Congress appeared in full, this being a very brief summary only.

## The location of the fall of Olaf Tryggvason

By Svend Ellehøj.

Why should we discuss the location of the defeat of the Norwegian king Olaf Tryggvason? Every child on this island knows, that Olaf fell in the year 1000 near the island Svold in a battle with the Danish king Svein Forkbeard, the Swedish king Olof Skotkonung, and the Norwegian Jarl Eric Haakonsson.

Every child on this island has read the description of the battle of Svold that was given by their great countryman *Snorri Sturluson* more than 700 years ago. They have followed Olaf on his voyage to Wendland in order to fetch the possessions of his wife, and they have followed him on his way back accompanied by Sigvaldi, the treacherous Jarl of Jomsborg. They have read the tale about the talk of the chiefs who were standing on the heights of the island, surrounded by their retainers, and they have felt the impression which the sight of king Olaf's own ship, the *Long Serpent*, made on the warriors. They have heard Olaf's contemptuous words about the Danes: "We are not afraid of those cowards; there is no courage in the Danes," and about the Swedes: "It were better for them to stay at home and lick their blood bowls than to attack the *Serpent* under your weapons," and his more appreciating words about Jarl Eric and his men: "From that troop we can expect a sharp onslaught; they are Norsemen, as we are." They have been delighted to see the Danish and the Swedish kings disgracefully withdraw from the battle. They have read about Einar Tambaraskelver and his broken bow, about the final victory of Jarl Eric, and about the uncertainty as regards the king's fate after the battle.

Why should we discuss the location of the defeat of Olaf Tryggvason? Could anybody know better than Snorri?

Fifty years ago most historians would have answered this question with 'no.' Snorri's description was followed everywhere, only a few details had been doubted. But in 1911 the Swedish historian *Lauritz Weibull* broke radically with the traditional conception and