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ANIMAL BONES FROM ITIVNERA, WEST GREENLAND

A REINDEER HUNTING SITE OF THE SARQAQ CULTURE

BY

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WITH 6 FIGURES AND 2 TABLES
IN THE TEXT

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Introduction

This paper is based on some of the bone material excavated at Itivnera (64°22′) in the summer of 1960 by Mr. JØRGEN MELDGAARD for the National Museum. The site is located in Kapisigdlit kangerdluat, a fjord at the head of the large Godthåbsfjord complex, about 30 km distant from the edge of Indlandsisen.

In addition to the material which is treated here, known as Group A, the most reliably dated part of the find, there exists material excavated in 1960, as well as material excavated by HELGE LARSEN at the same site in 1958. DEGERBØL described the reindeer bones from the latter find in 1959 (p. 71).

C 14 dating (K 588) places the age of the find at 1,010 ± 100 B.C. (TAUBER, 1966, p. 120); it is a characteristic Sarqaq Culture reindeer hunters' settlement.

Find Conditions and Quantity of Bones

The material consists of bone fragments found in a midden containing refuse from one or two houses; all of the bones were found in a 16 sq. m. area where the whole culture layer was investigated. The layer was about 30–40 cm below the surface. As a result of marrow splitting and similar treatments, the bones are extremely fragmented; complete limb bones are exceptional. The state of preservation tends to be poor; many bone extremities are partly disintegrated. The *diaphysis*, or the bone shaft, is often peeled; this is particularly true of the relatively numerous bones of juvenile animals, whose spongier bone walls are more readily damaged. Teeth are, however, comparatively well-preserved.

The more or less uniform size of the fragments is determinable by means of counting and weighing. There is an average of 335 fragments per kg., which indicates pronounced disintegration. Weighing and counting give a total number of ca. 6,450 fragments from the above-mentioned 16 sq. m. area; this coincides with the preliminary count during the excavation, when the number of bones was estimated at ca. 6,000.

The number of species is limited; there are 5 species of birds and 4 of mammals. Apart from a few species such as eiderduck and guillemot and, in particular, reindeer, whose abundance in the find justifies the name "reindeer hunters' site", the number of individuals is also small.

Out of the total number of 6,450 fragments reindeer bones comprise 6,140 or ca. 95 %; seal bones make up no more than 2 % and bird bones 3 %.

List of Species

Listed below are the number of bone fragments which could be accurately identified, together with the total number of birds, seals and reindeer.

Birds, *Aves:*	No. of fragments
Cormorant, *Phalacrocorax carbo*	1
Arctic eider, *Somateria mollissima borealis*	45
Glaucous gull, *Larus hyperboreus*	1
Iceland gull, *Larus glaucoides*	3
Short-billed guillemot, *Uria lomvia*	56
Unidentified birds	70
Total number of birds	176

Mammals, *mammalia:*	No. of fragments
Arctic fox, *Alopex lagopus*	6
Harp seal, *Phoca groenlandica*	14
Bearded seal, *Erignathus barbatus*	2
Unidentified seals	110
Total no. of seals	126
Reindeer, *Rangifer tarandus*	6,140

As the above figures show, apart from the reindeer bones, the bones of other animals comprise only a minor part of the find; consequently, no firm conclusions can be based on them. It can be adduced that the above-mentioned species still occur in the district; with respect to the guillemot, however, this species occurs only exceptionally. No doubt the Ringed Seal, *Phoca hispida*, was accidentally omitted from the Itivnera material; the few fragments that were reliably identifiable could be referred to the Harp Seal and the Bearded Seal.

Reindeer

Since the Itivnera settlement clearly is based on reindeer hunting, this paper will only concern conditions related to this game, essentially from an archaeological point of view.

The collection comprises bones from the whole skeleton, ranging from the skull through the vertebrae and ribs to limb bones and toe joints; this indicates that whole animals or parts of them were brought back to the settlement.

Accordingly, this settlement presumably was located as closely as possible to the reindeer's habitat or migratory routes, which made it possible to bring back the game with a minimum of effort. Furthermore, the settlement was situated at a place where seals and sea birds could supplement the inhabitants' diet.

Considering the above-mentioned presence of bones from the entire skeleton, it would make sense if the various bones had been found in a suitable relationship to one another; this is by no means true, however. There is an extremely wide and at times remarkable difference in their distribution, which is scarcely possible to interpret satisfactorily; several unknown circumstances may have been responsible for this. As mentioned above, the state of preservation is rather poor; bones such as ribs and vertebrae are particularly susceptible to disintegration, which to some extent may be the reason why these parts of the animals are in the minority. On the other hand, fragments of the limb bones, or *diaphysis*, which are very hard and more easily preserved, also are the most numer-

ous of the bone finds. Yet even in this category there is a clear disparity. The cannon bones, *metacarpus* and *metatarsus*, which are uniform anatomically and culinarily, provide an extreme example, for these diverge to the greatest extent in number. Thus, while there are only 33 fragments of the *metacarpus*, there are 293 of the *metatarsus*, a striking difference which cannot be a result of the conditions of preservation, which are uniform for these bones. Nor is it possible that the fragments were incorrectly determined, for these bones are extremely easy to distinguish. It is scarcely possible to determine whether the reason for this situation can be ascribed to practical factors such as packing of the meat in hides during transportation to its destination, or whether other factors were responsible.

Fig. 1 shows the number of the various bones contained in the find; yet a number af small fragments are not included here, but simply make up the total number of reindeer bones. Since the sorting is uniform, this cannot be responsible for the above-mentioned disparity, either.

To some extent the large amount of available material should make possible the clarification of two significant questions: the number of individuals and the period of settlement.

Apart from the uncertainty that always is present when determining numbers of individuals, the first question should be relatively easy to answer. The metatarsus (293 specimens) occurs most frequently; in this settlement it is only found in three parts, upper, middle, and lower (mentioned under Marrow Splitting, p. 00). The middle part, *diaphysis*, was used as the basis for counting the number of individuals; 82 and 81 are right and left parts, respectively (a satisfactory correspondence). This gives a number of at least 82 reindeer in the 16 sq. m. are that was investigated.

According to the 1957–58 list of catches published by the Ministry for Greenland (the list recorded, i.a., the weight of the respective chaseable species of game calculated on the quantity of meat and edible viscera), the average reindeer weight given is 60 kg; with respect to the 82 Itivnera reindeer this corresponds to a meat quantity of 4,920 kg, or almost 5 tons.

This is a considerable amount of meat; even though there always is a margin of error in calculations of this kind, they nevertheless provide a background for further conclusions. If the consumption of meat is estimated at 1 kg per person per day, there would be sufficient meat for one individual for almost 14 years, or for 50 persons for ca. 3 months.

If the settlement lasted for only a little more than ca. 1 month, which is presumable (see p. 12), according to the above conclusions 150 people could have occupied one or perhaps two houses; for lack of space alone this is out of the question. This circumstance, along with the

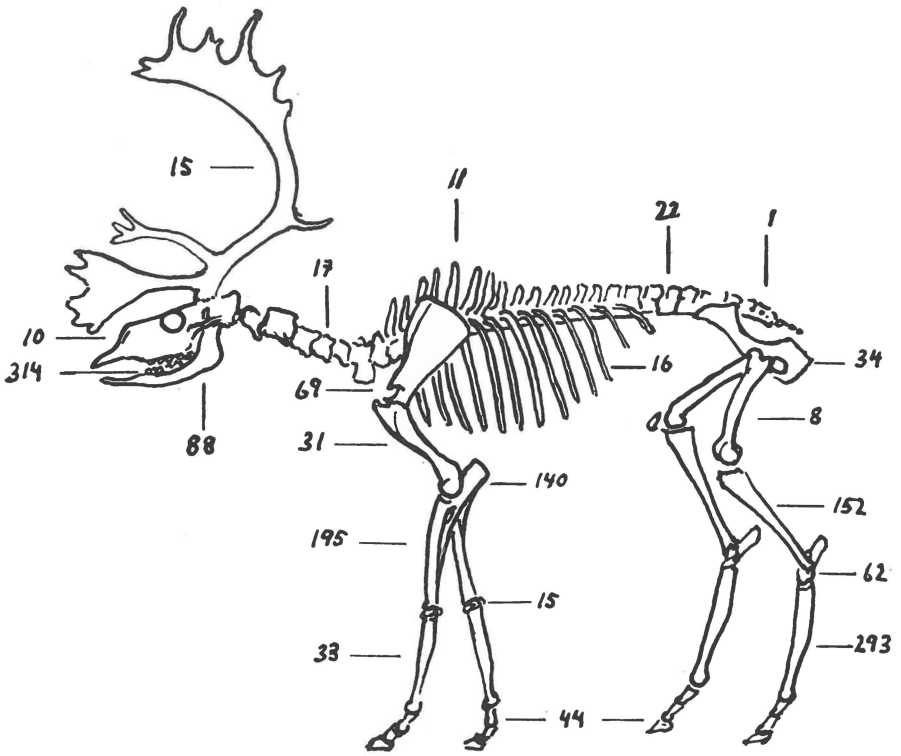

Fig. 1. Skeleton of reindeer, with statement of number of bone fragments found.

following reason for a settlement of short duration, calls for other interpretations. There seem to be two possibilities here: 1) considerable amounts of meat were dried and removed to other settlements; 2) there was a spot to which people returned at the same season over a period of years, depending upon the reindeer's migratory routes and habitats. Both explanations are acceptable, but a combination of the two seems most likely. This corresponds to current practice; for example, at a specific season the Greenlanders go to the places where salmon are known to spawn, or to bird cliffs where eggs can be collected in the breeding season. This also applies to reindeer hunting. The annual cycle of the game determines the dwelling place of the hunters. Many examples of this type of "nomadic" hunters could be mentioned.

The seal bones from this settlement, their small number notwithstanding, show that this method of hunting was tried. Presumably there were other seasonably-determined settlements having the same culture, but these were situated nearer the coast, where seal bones comprise a dominant part of the material.

Season of Occupation

In regard to the second question, the season of occupation, this can best be answered on the basis of the secondary dentition and attrition of the teeth in the jaws of the numerous young reindeer.

There are 88 lower jaws, several of them with teeth. These jaws consist of 40 right and 48 left jaws. Six of the latter are juvenile, i.e., the secondary dentition is incomplete and milk teeth occur at various stages of cutting and detrition. In addition to these jaws there are 314 detached teeth, including some milk teeth. The lower posterior milk molars (d.p. 4) include 14 right ones which are so well-preserved that the stage of detrition is determinable; when the 6 above-mentioned lower jaws, in which d.p. 4 also is retained, are added to these, there is such a large number (20 dextra) that the condition of these teeth can reasonably be used as a seasonable criterium.

All of the juvenile jaws and detached teeth (d.p. 4) can be divided into two more or less distinctly separate groups: 1) the quite young calves born in the spring, in which d.p. 4 is beginning to detrite and the first permanent posterior molar (m 1) is about to cut through the gingiva; 2) the older calves or young animals, whose d.p. 4 is heavily detrited and whose m 1 and m 2 have cut through and are beginning to wear down (Figs 2 A and B).

According to BANFIELD (1954) these two stages of dentition and attrition represent the following onto-genetical ages: the younger, Group

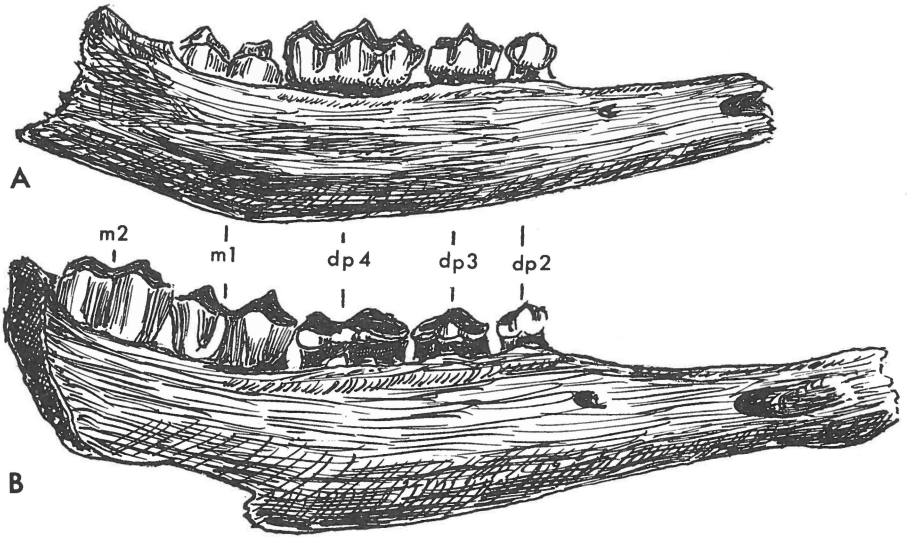

Fig. 2. Lower jaws of young reindeer from Itivnera. A, ca. $1^1/_2$–2 months old. B, ca. 14 months old.

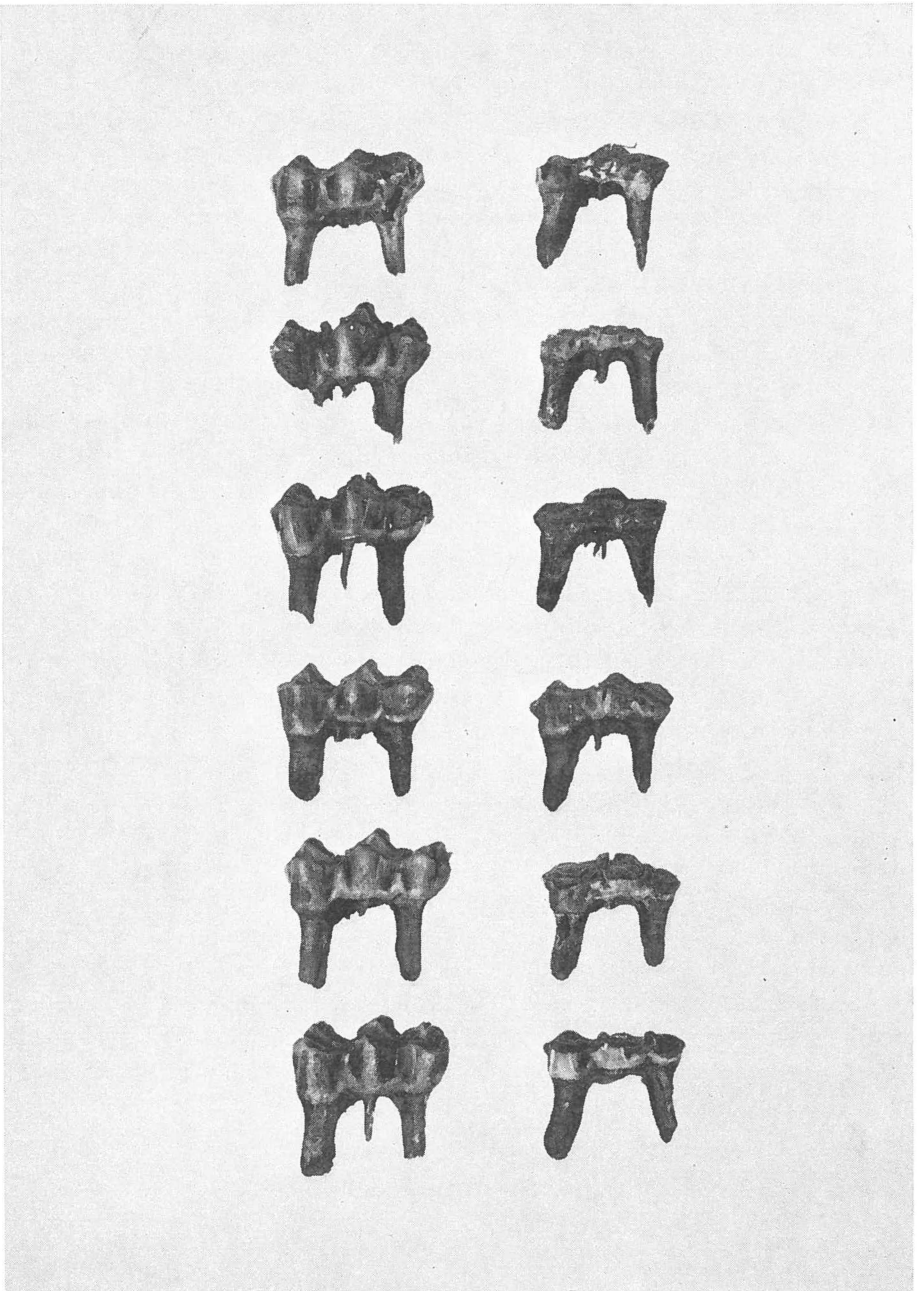

Fig. 3. Posterior lower milk tooth (d.p. 4) of reindeer from Itivnera. The two rows show the stated difference of 12 months, *cf.* Fig. 2.

1, is ca. $1^1/_2$–2 months, the older, Group 2, is ca. 14 months, which gives a difference in time of approximately 12 months.

Thus these animals were killed in the same season, and since no intermediate stages of dentition or detrition have been observed, it appears reasonable to assume that the settlement was used for only a limited period; this can be assumed as having taken place in late July and early August, as the maximal reindeer calving presumably occurs in mid-June.

There can be earlier and later births, but these have no marked effect on the above-mentioned stages of wear, which seemingly are common. Fig. 3 shows that this applies to 12 right posterior lower teeth, which can be divided into two age groups: on the left, the ca. 2-month old calves, on the right, the ca. 14-month old ones. This corresponds to the jaw parts shown in Fig. 2 in which an additional 7 have the above-mentioned d.p. 4 *in situ*. Only a single jaw fragment indicates a more advanced detrition of this tooth than the rest of the ca. 2-month old calves to which it nevertheless belongs.

It is difficult to determine whether general conclusions about the form of settlement of this cultural phase in various places can be based on conditions in Itivnera, but it seems likely that hunters whose livelihood depended on such shy and itinerant game frequently had to move in order to utilize shifting hunting grounds and that, in particular, they were forced to keep track of the reindeer's seasonably-conditioned migrations. According to information provided by CHR. VIBE, today's reindeer population in the same area migrate to the coastal grazing places in the summer, staying there from late April to September-October; thereupon they move to the lichen-covered areas along the inland ice, where they spend the winter months. Had reindeer hunting been the staple occupation throughout the year, one could reasonably expect to find settlements at other localities where the reindeer's teeth would indicate the age of the game at other seasons. As far as I know, however, nothing of this nature has been demonstrated. In view of the seal hunting at the place in question, it seems likely that, as at the present time, reindeer hunting depended on the season, while seal hunting and other means of livelihood were the staple occupation at other times of the year and at settlements closer to the coast.

Marrow Splitting Technique

No matter if an Early Stone Age hunting settlement or a Later Stone Age farming culture with animal husbandry is concerned, the bones are always heavily broken as a result of marrow splitting or another means of crushing; the purpose of this was to obtain the desirable marrow, and marrow bones are even sold today.

There are a few technical differences between the marrow split bones from Itivnera and the bones of red deer from Danish hunting settlements;

presumably the main reason for this is the reindeer's special bone structure.

The reindeer and the red deer closely resemble one another in size (weight), but the reindeer's bones, in particular its limb bones, are markedly thinner, and the cavity that contains the marrow, *cavum medullare*, is larger. The yellow marrow, *medulla flava*, consists of ca. 96 % fat; when the animal is young, however, red blood corpuscles are produced in this marrow. Since the marrow is red, *medulla rubra*, and not tempting to eat, marrow split bones of juvenile animals are rarely observed.

The most significant technical difference in the treatment of the reindeer bones from Itivnera and the corresponding red deer and roe deer from the Danish Stone Age settlements is that in Itivnera the long limb bones, especially the *metatarsus*, were not split by the customary side strokes which split the bone longitudinally. The upper and lower ends were chopped off, leaving the central part of the *diaphysis* intact; thus this functioned like a tube from which the marrow is easily extracted (Møhl, 1954, p. 112). It would be natural if the thin-walled reindeer bones were responsible for the mentioned crushing technique, which also is characteristic with respect to the treatment of the rest of the limb bones. Meiendorf, in the vicinity of Hamburg, Germany, a well-known reindeer hunting settlement of the late glacial age, is one of the places where the same animals were the dominant game. In a chapter of A. Rust's publication (1937, p. 51), W. Krause writes: "Die zahllose Bruchstücke von Röhrenknochen, bei denen beide Gelenkenden abgeschlagen sind, sind nicht berucksichtig worden . . .".[1]) Thus, the same procedure also was used here: cutting off of the upper and lower ends of the bones.

Provided that further clarification of this matter is desirable, it is necessary to revert to West Greenland, but to a different people and a different culture, that of the Norsemen (Vikings) in the Western Settlement; this was excavated by Nørlund and Roussell in 1930–34, and treated from a zoological point of view by Degerbøl (1936, p. 4). The find contains a considerable number of reindeer bones; this clearly shows that the Norsemen's marrow splitting technique differed significantly from the one the Eskimos used.

A re-examination of this material reveals that there are numerous *metatarsals* which were cut longitudinally by means of the customary side strokes, a procedure which also can be observed with respect to other long limb bones such as the *tibia* and the *radius*; this indicates that whereas the old Danish technique was used in treating the reindeer bones, the Meiendorf and Itivnera specialists used another and presumably more effective procedure.

[1]) The innumerable fragments of limb bones with both ends severed have not been taken into consideration.

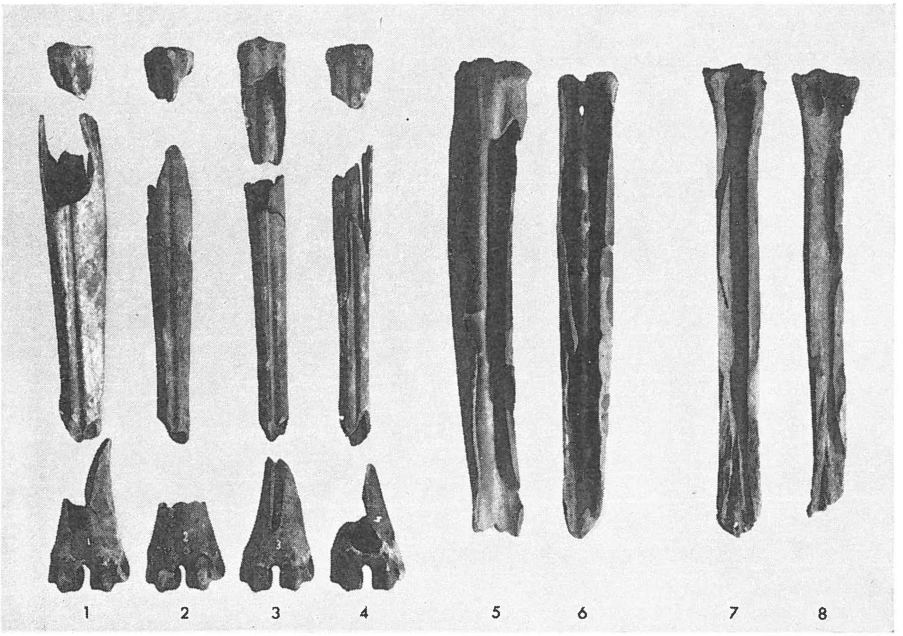

Fig. 4. Two forms of marrow splitting technique: num. 1–4, *metatarsus* of reindeer from Itivnera with cutting of upper and lower ends; num. 5–6 from Umîviarssuk, West Greenland, split longitudinally by Norsemen; num. 7–8, *metatarsus* of red deer, *Cervus elaphus*, from a Stone Age settlement in Åmosen on Sjælland. The latter bones show the same marrow splitting technique as num. 5 & 6, the technique used by the Norsemen.

It is interesting to note that despite the considerable difference in time and place, the same technique was used in Meiendorf, Germany, ca. 10,000 B.C., and Itivnera, West Greenland, ca. 800 B.C. On the other hand, the Norse immigrants in Greenland, ca. 1,000–1,350 A.D. used the technique familiar to them from home. This can be seen in Fig. 4, left, where fragments of four *metatarsals* with severed lower ends are depicted along with two from the Norse settlement which resemble the two fragments, shown at the right of the figure, of red deer from a Stone Age settlement in Åmosen (Ravnsbjerggård) on the island of Sjælland in Denmark. This figure also makes possible a comparison of the thickness of the bone walls at the point of fracture, where it can be seen that the wall of the reindeer bone in question is only ca. $^1/_3$ as thick as that of the red deer; both species, however, show some thickening with age, but in the same relative proportion.

The above-mentioned technique clearly dominates in Itivnera, where the find contains 163 similarly treated specimens; none of these, however, is split longitudinally.

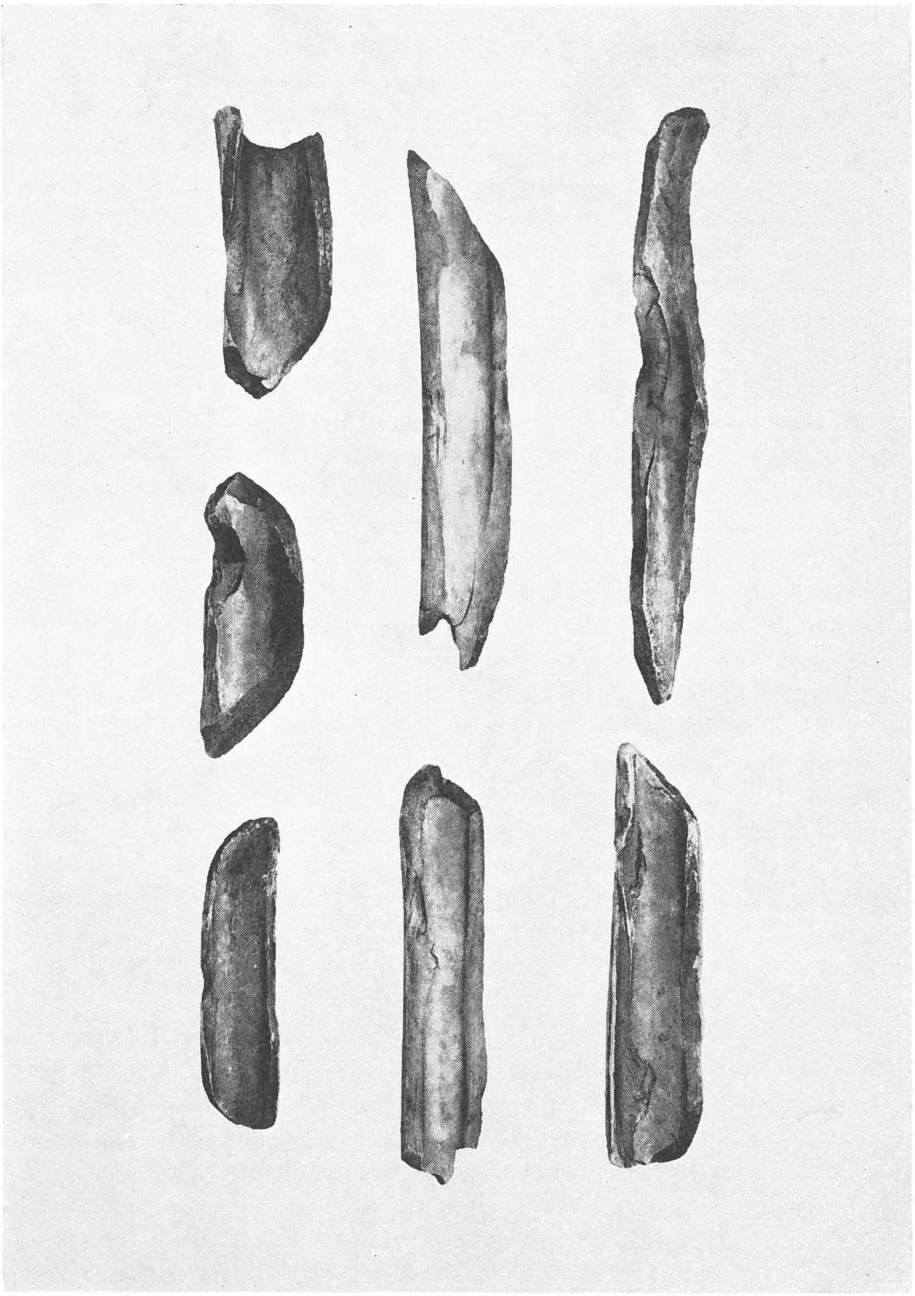

Fig. 5. Fragments of limb bones of reindeer from Itivnera with striking marks and internal bursting of the bone wall, typical of specific striking areas.

Yet a more normal striking technique also was used. Some selected pieces, Fig. 5, of the *femur* and the *tibia* clearly show marks of strokes

with corresponding internal crushing of the bone wall as a result of direct blows on the external part of the *diaphysis*.

The more or less intact lower jaws which occur in considerable numbers in Itivnera are remarkable. At Danish hunting settlements the under side, or keel, is commonly severed, not only with respect to deer, but also to smaller mammals, even those no larger than the pine marten. The Itivnera reindeer jaws are intact; a severed "keel" is exceptional. It has been believed that the reason for this chiseling of the lower jaw was a craving to reach the fat-covered nerve fibres in this long channel, *canalis mandibularis*, just as the vertebrae were split or crushed for the purpose of extracting the delicious spinal marrow.

The above-mentioned channel, which is situated under the molar roots, ends anteriorly at the external side of the *foramen mentale* at the base of the muzzle, and posteriorly on the internal side of the ascending branch of the jaw in the *foramen mandibulare*. No doubt the chiseling of the lower jaws as explained above remains valid. But another view has been put forth. E. PETERS (1932, p. 162) mentions the possibility that on the basis of bone material from the Magdalenian period, the final phase of the Würm Ice, the nerve fibres in question were used as threads for sewing. "Der Zweck war jedoch anscheinend hier, den Alveolarkanal freizulegen, um die sehnigen Nervenhüllen zu erlangen. Diese können zu einer ganzen Reihe von etwa 15 cm langen Fäden zerfasert werden."[1]) Although this possibility cannot be rejected, it does not exclude earlier theories. If, as mentioned above, the lower jaws of the pine marten, an animal in which the length of the nerve fibres scarcely exceeds ca. 4 cm., were chiseled in this way, it seems doubtful that this theory is the only valid one. Furthermore, the reindeer's neck and back sinews contain considerable and excellent thread material, and it was precisely the chiseled lower jaws of this animal from the Magdalenian period on which Peters' theory was based.

The only thing that is clear is that there is a definite difference in the treatment of the reindeer jaws from Itivnera and the corresponding ones of red deer from the Danish hunting settlements. Presumably, the reason for this is simple; the hunting season in Itivnera was brief, there was easy access to fat and marrow in the more readily accessible parts of the animal, and there was no need to chisel the lower jaws.

RUST (1937, p. 142) writes about the reindeer jaws from the settlement near Meiendorf: "Sämtliche gefundenen Unterkiefer sind zur Markenthame aufgeschlagen". (All lower jaws found were split for marrow). That is, the same technique was employed. As far as intact lower jaws are concerned, Itivnera apparently is exceptional to date.

[1]) "The evident intention was, however, to expose the alveolar channel in order to obtain the tendinous nerve fibres. These could be split up into ca. 15 cm long threads."

Antlers

With respect to antlers, which always have been suitable and consequently extensively used for making tools, but a few (15) poorly preserved fragments have been found. These include three fragments in which distinct marks show that the groove incision technique was used to open parts of the antlers; e.g., when a carving tool was repeatedly moved in the same groove the outer thicker wall of the antler was penetrated, whereupon the desired part could be separated. (MØHL, 1962, p. 886). The traces of this work are imperfectly preserved, namely in the remains of refuse which lay nearby the implements which were used. Without taking the working technique into consideration, it can be seen that the smoothly carved edges have been more resistant to the ravages of time than the rough edges of fractures and other severely damaged parts of the antler. The carved surfaces are clean, smooth, and hard, with very indistinct longitudinal grooves, traces of the tool's movement in the groove.

Zoological Comments

Since reindeer bones comprise ca. 95 % of the total number of fragments contained in the considerable amount of material from Itivnera, by estimating the size of these animals' teeth and bones in relation to those of today's reindeer it is possible to gain an impression of the environmental conditions under which the Itivnera reindeer lived.

The reindeer which the Itivnera people hunted were smaller than today's reindeer. DEGERBØL (1959, p. 71) reports on the size of the teeth as determined on the basis of material obtained from the same locality in 1958. He states that 11 lower posterior molars (m) measure between 17 mm and 19.5 mm, while those of the present population vary from 20 mm to 25 mm, with but a few measurements being above and below this variation.

The material excavated in 1960 shows correspondingly small teeth; yet there is a slightly larger variation, for the length of 16 lower molars (m 3) is between 17.6 mm and 20.8 mm. In both finds m 3 often has a rudimentary posterior column, or this is non-existent.

This dentition is shown in Table I; here the lower row (crown height of m 3) indicates the relative ontogenetic age via the progressing detrition (decreasing crown height from no. 1 to no. 16. Thus, nos 15 and 16 show that the tooth has been worn down to such an extent that the crown height is less than half of that of unknown teeth, and the ontogenetic age is presumably ten years; on the other hand, no. 1 is not worn, representing a calf ca. 14 months old.

Table I. Reindeer (*Rangifer tarandus*).

Measurements in mm.	Measurements of teeth from lower jaw															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
p2–m3		93							88							
p2–p4		42,5							37							
m1–m3		55	55	55	53,5		55		52		52					
m3 greatest length	19,5	20,5	18,6	19,2	17,8	19,8	18,1	18,8	18,1	19	17,6	20,2	20	20,8	18,1	18,1
m3 greatest breadth	9,7	9,7	9,7	9	9	9,3	10	9,5	9,5	9,3	9,5	9,4	10	9,5	9	9
m3 height of crown*)	15,5	14,2	14	14	14	14	13,8	13,2	13	12,8	12,5	12	9,8	9	7	6

*) Measurements taken on the inner side of the anterior lobe.

Table II. Reindeer (*Rangifer tarandus*).

Measurements in mm.	Radius (*radius*)					Cannon bone (*metacarpus*)				
	West Greenland	East Greenland		West Greenland		West Greenland	East Greenland		West Greenland	
	Itivnera (♀)	Scoresbysund ♀ RYDER, 1892 CN 592	Danmarkshavn (♀) B. MØHL, 1957	Holsteinsborg ♀ R. MÜLLER, 1899 CN 880	Nûgssuaq ♀ H. FENCKER, 1955 CN 2976	Itivnera (♂)	Scoresbysund ♀ RYDER, 1892 CN 592	Danmarkshavn (♀) B. MØHL, 1957	Godthåbsfjord ♂ CHR. VIBE, 1943 CN 2726	Godthåbsfjord ♀ CHR. VIBE, 1943 CN 2720
Total length	223		220	290	235	161	168	163	195	191
Proximal breadth transv.										
Proximal breadth transv.	38		41	56	45	30	32	32	39	36
— — ant.-post.	24		23	30	26	22	23	24	28	26
Middle breadth transv.	28		22	35	23	23	20	17	27	20
— — ant.-post.	15		14	22	16	18	18	16	23	20
Diaphysis smallest breadth transv.	24	22	19	34	21	22	20	17	27	20
Distal breadth transv.	36	40	39	50	40	38	40	39	48	45
— — ant.-post.	26	29	28	32	26	18	20	20	25	23

The dentition indicates that the Itivnera reindeer were small in size, or that there were individuals with remarkably small teeth.

The limb bones also are small. Although exact measurements can only be made exceptionally, the general impression is that small animals definitely dominate the population.

As far as intact limb bones are concerned, the find contains only one *radius* and one *metacarpus* (Table II), but these two bones are of such a small size that they closely correspond to the small East Greenland reindeer RYDER found near Scoresbysund at the close of the 19th Century (1892) and which Nathorst was the last to observe in 1899; since then the reindeer have neither been seen in East Greenland nor returned there.

DEGERBØL (1957) classified this small East Greenland reindeer as a distinct subspecies (*Rangifer tarandus eogroenlandicus*). As shown above, the limb bones from Itivnera are of the same size, and according to some measurements still smaller; in contrast, the measurements of the present West Greenland reindeer population are considerably larger, *cf.* Table II. Fig. 6 shows a series of *metacarpals* of Greenland reindeer. No. 1 derives from the Itivnera find and unquestionably is a bull's bone, which is recognizable by the thickness and breadth of the *diaphysis* in comparison with the upper and lower limb extremities. No. 2 was removed from a hide RYDER brought home from Scoresbysund in 1892 (C.N. 592).

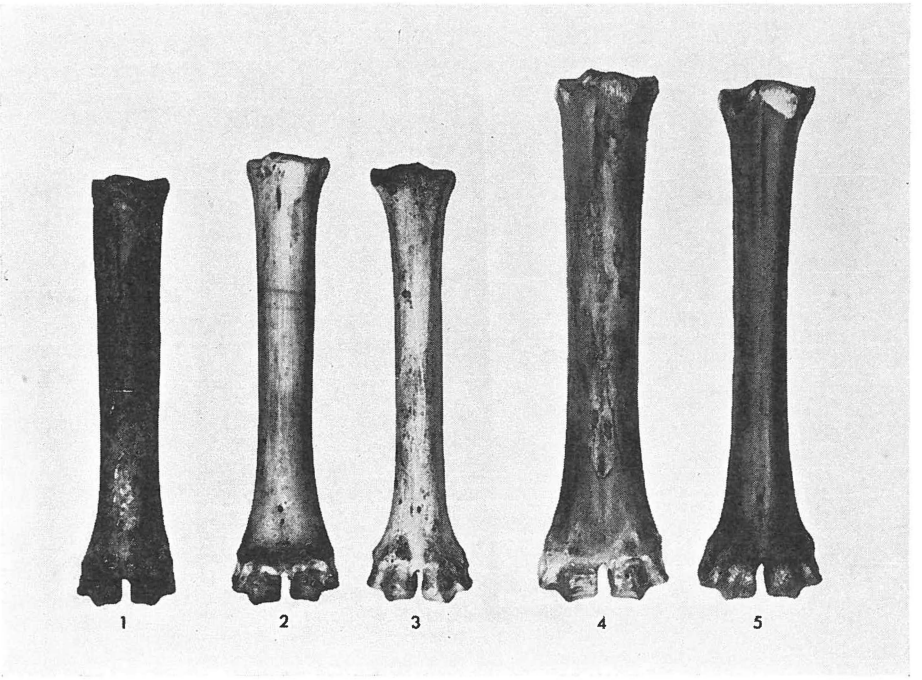

Fig. 6. *Metacarpi* of reindeer. The difference in size is indicative of unfavourable or good environmental conditions, as well as the sexual dimorphism. No. 1 bull (♂) from Itivnera, No. 2, cow (♀) from Northeast Greenland, RYDER, 1892 (CN 592), No. 3, an even weaker ♀ from Danmarkshavn, Northeast Greenland, subfossil collected in 1957, nos. 4 & 5, ♂ and ♀, from the present population near Godthåb, which lives optimally.

No. 3, which B. MØHL found near Danmarkshavn in 1957 is, on the other hand, a typical reindeer cow with a slender *diaphysis*, strongly curving outwards toward both ends, belonging to the small East Greenland form. Nos 4 and 5 are a bull and a cow (CN 2726 and 2720) from the present Godthåb population; in addition to the general sexual dimorphism these bones exemplify the size attainable where the environment is favourable.

Judging from the size of the limb bones, the now extinct small East Greenland reindeer and the West Greenland reindeer dating from the time of the Itivnera people resemble one another; to an extent there also is a likeness with the small, or Peary reindeer from Ellesmere Land and the Spitzbergen reindeer, both of which are small varieties of the species who live at the outer periphery of the reindeer areas. Subfossil bones, of correspondingly small, and in some instances, even smaller individuals, are also known from Western Alaska, Trail Creek, ca. 6,000 B.C. (HELGE LARSEN, 1968, p. 57). The variation in size indicates that

the reindeer are remarkably rapidly affected by environmental factors, which, in turn, are subject to climatic conditions; the reindeer's main diet consists of lichen, whose growth depends on the degree of humidity, and dry periods are fatal, first and foremost as far as the lichen is concerned, next the reindeer.

In accordance with the duration and intensity of these unfavourable periods, the reindeer population presumably will show a decline in number as well as in the size of the individuals. In extreme instances they may become extinct, as in East Greenland, provided that they are unable to migrate to regions which are more climatically propitious; this was the case in Greenland, where the east and west coasts provide two pockets which permit immigration from Canada in favourable periods, but prevent return migration during inauspicious periods. The deterioration of the climate comes from the north, forcing the game southwards, and at the same time preventing a possible return. Information concerning the above was provided by Chr. Vibe.

Since climatic fluctuations are the primary cause of the varying size and number of the Itivnera reindeer, these animals must be looked upon as a "Kummerform" from an unfavourable period.

It is, however, impossible on the basis of this isolated find to determine whether the reindeer population of that period gradually died out and a subsequent immigration took place, or whether, because of the improved climate, the animals again managed to find enough food for survival; the latter was true of the musk ox in Northeast Greenland after ca. 1900.

Summary

Studies of the bone material from the ca. 3,000 year-old Sarqaq Culture settlement at Itivnera have given the following significant results:

The settlement must be designated as a pronounced reindeer hunters' place. The bones of this game represent 95 % of the total number of bones. Seals and birds comprise 2 % and 3 %, respectively.

On the basis of the cutting and detrition of the teeth in the lower jaws of the reindeer, it can be determined that the place probably was inhabited for only a short season, from late July until early August; hunters returned to the same place at the same time, year after yerar.

The marrow splitting technique shows similarities with that of quite different people who also specialized on reindeer hunting, for example, European hunters of the late glacial age. There is evidence, as well, of a different technique used by the Norsemen in Greenland in their treatment of the same animals' bones.

From a zoological point of view mention has also been made of the small size of the reindeer at the time of the Itivnera people, and has been attributed to climatic conditions. Comparisons have been made among the extinct East Greenland reindeer, the Itivnera reindeer, and the present optimal population in West Greenland.

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