

Pat please check spelling of Ganaq I think it was  
Kanak. The Ganaq<sup>a</sup> is preferred. Stulbsia Ganaq

Continue

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Professor Kofoed-Hansen next turned his attention to the hunting procedures, food habits and customs of the Greenlanders. But it was obvious that he was out of his element and Professor Koch took over. All of the early information was obtained from Mr. Ziglersen and from the Greenlanders with Ziglersen translating. Later, after Feb. 1 this information was corroborated and amplified by the arrival of four additional Danish scientists; Dr. Frede <sup>H</sup>armann, Hydrographer, Ministry of Fisheries; Mr. Borge Fristrup, Head of Department, Geographical Institutet; Dr. Christian Vibe, Assistant Professor, Zoological Museum, Univ. of Kobenhavn; and Dr. Paul Marinus <sup>Hansen</sup> ~~Hansen~~, Head of the Greenland Fisheries Research Department. These were all "old Greenland Hands" who were more explorer-naturalists than scientists like Koch and Kofoed-Hansen.

check if first part for consistency of story

Sketch intended?

It turned out that they were placed in secondary roles, but their information and knowledge of the area was essential for planning a monitoring surveillance program. Two technicians from Dr. Gjørup's laboratory, at Resø also arrived with alpha spectrometry equipment which they set up in an empty barrack. This was to be used extensively during

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For the next 6 to 8 months. When we learned that the Danes intended to double their scientific personnel, there was at first a thought to match them man for man. General Hunziker, however, was aware that the Danes were primarily interested in ensuring the biologic safety of the local environs and the Greenlanders. I agreed to my suggestion to bring Dr. John Wolfe, Chief of the Environmental Sciences Branch of DBM and an experienced Arctic ecologist, to Thule. He arrived shortly before the second contingent of Danes, one of whom, Fristrup, was a personal friend. This added greatly to the understandings being

worked out as to what would be advisable for a sound <sup>surveillance</sup> ~~monitoring~~-ecological program. The Danes were strong for <sup>surveillance</sup> ~~monitoring~~, whereas Dr. Wolfe and I were more interested in the ecology of the area.

I felt strongly, and still do, that reactors are the ideal power sources for life and ~~work~~ work in the Arctic, ~~to~~ and Thule with its facilities is an ideal base from which to conduct studies of how reactors would influence the rather simple but extremely critical items <sup>making up</sup> of the ecological web. Professor Koch considered my <sup>arguments</sup> ~~proposal~~ for such a study, hopefully on a joint basis, and promised to give an answer <sup>sp</sup> "later". He answered when we met in <sup>Copenhagen</sup> ~~Kopenhagen~~ in <sup>mid-</sup> ~~late~~ February. In brief, the Danes did not wish to seem to be calling ~~attention~~ attention to Thule and the accident by setting up an ecological research program there - maybe later. Meanwhile they would carry out studies of the Pu contamination of the environment.

Pat: lots be concerned on spelling in preceding Experiments

... which is a common name for the Arctic.

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The following is a composite-summary of information about the bio-ecology of the area gathered from interviews with Mr. Ziglersen; a group of Greenlanders with Ziglersen translating; Danish people working on the Base, and lastly Drs. Herman <sup>n</sup> <sub>r</sub> Vibe and Marcus Hansen.

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North Star Bay is a favorite hunting ground for the Greenlanders because the ice tends to be thin or to break into leads, so that the seals <sup>can surface and hence they</sup> remain in the area; the straits off shore are the last to freeze solid, due apparently to an eddy created by the current flowing northward along the western shore of Greenland, being turned westward ~~into~~ <sup>north of Thule</sup> by the shoulder of Greenland, and then meeting a strong southerly flow pouring

Hennemann

out of the Kane Basin. Altogether the eddy creates a favorable environment for plankton, shellfish, and sea life in general, <sup>specially</sup> including sea mammals.

~~The area about~~

There are about 80 to 100 people living in the immediate vicinity of the bay ("15 to 20 families") and possibly another 100 may come in, stay awhile and move on again. Not more than 600 Greenlanders was estimated for the entire population of this northwest corner of Greenland. The word "about" has to be used because the Greenlander normally is nomadic peripatetic, thinking nothing of putting his family and things on his sledge and crossing the Bering Strait to Ellesmere Island, Canada, if the dogs are in good condition. He goes where he thinks the hunting is best; his social status rests solely on his ability as a seal catcher, "faenger". The Danes have been trying to settle them in villages by offering food, medical aid, housing, education, and trade goods, but with only modest success.

It was agreed, however, that the habits of the Greenlander are changing: They no longer eat blubber nor use it for lamps and heating; it is fed to the dogs and they use kerosene or a primus stove. Their rifles increase their food gathering effectiveness so they live largely on seal meat. On the other hand, they will trade walrus ivory for powdered milk which they have come to love. The Greenlander eats about 180 lbs of lean seal meat per year. During the summer he supplements his diet with mussels, birds eggs, berries and an occasional fish. "We go fishing in summer only to escape the mosquitos" sums up their attitude toward fishing; actually the polar cod, the chief indigenous fish, is mostly gristle

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and bones. They catch <sup>large</sup> ~~fair~~ numbers of eider ducks, auks and related species and freeze them for use during the year by dropping them into pits in the permafrost. They will eat the occasional arctic fox, hare, "ice-bear", raven, or ptarmigan they may chance upon. And, if a whale is sighted in the Strait, everyone ~~within~~ goes after it; if it is caught everyone within range of the bush telegraph shows up for a gluttonous fiesta lasting up to a month. The Greenlander is a compact, rugged, friendly, intelligent individualist who will pick up new ~~habits~~ <sup>ways of doing things</sup> if he is persuaded that they will help him survive in this most inhospitable climate. He seems to know that he can't depart too far from his <sup>locus</sup> ~~place~~ in the ecological web without courting disaster.

Locus

The sledge dogs are a critical component in the Greenlander's culture. As long as they are in good condition and fertile he can go about his food gathering. They are nasty brutes that just don't quite dare attack their master, although stories were told of the dogs killing their master when he got sick and vomited, or cut himself, etc. They are trained from the beginning to respond to a whip or club, so that ~~when~~ the driver <sup>commands instant obedience from them.</sup> ~~yells~~ go there is no question about going.

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The dogs decide among themselves who is leader and the order of precedence; ~~and~~ the driver has to hitch each by its trace in that order, the leader having the longest trace and placed in the center. The dogs are <sup>routinely</sup> fed frozen ~~walrus and offal~~ walrus and offal; walrus meat and skin was said to be too tough for any other purpose. If a dog is injured or if the leader is deposed, it is shot, skinned and the carcass fed to the other dogs; the skin is made into linings for ~~the~~

mukluks. The life span of the dogs is about 5 years.

The number of animals caught and used per year at North Star Bay as given by the Greenlanders is about:

1. Seals shot anywhere in the vicinity: 1000
2. Walrus killed in the shallows around the two islands (shown on Figure VII): 75
3. Arctic foxes shot on land: 200
4. Arctic hares shot on land: 20
5. "Ice-bear" shot on the edge of the ice: 3
6. White whale ~~and/or~~ <sup>or</sup> ~~barvik~~: <sup>Seldom</sup>
7. Birds

*norwhal*

*guillemot*

a. Land: Ptarmigan: "as many as possible-can't say"  
 b. Migratory seabirds: Eider duck, little auk, guillemot and long-tailed duck. These nest extensively on the ledges of Saunders, Wolstenholme, Iganak, and Ederfugel Islands and Cape Athol, making this area a major rookery of the northland. The birds live on mollusks, crustaceans, small fish and planktonic material ~~in~~ <sup>in</sup> the waters. The eggs are taken and the birds slaughtered from the time they arrive beginning in May. Numbers were not estimated. The Danes are trying to restrict egg gathering to a single clutch as the birds will re-lay.

8. Fish. The ~~plar~~ <sup>lar</sup> cod is eaten mainly by the seals; other unnamed ~~large~~ <sup>small</sup> fish present, but fish are not eaten.

9. Mussels: The bottom is rich in various types. Where the shore is shallow the Greenlanders will wade out to gether the mussels for "snacks" in summer. The ~~walrus~~ <sup>walrus</sup> stomach contents ~~of the walrus which consists~~ <sup>consists</sup> ~~exclusively~~ <sup>consists</sup> of mussels (see Annex VII) is eaten in its half-digested form as a special treat.

*Consisting*

10. Plants.

*ends up in*

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A. A small berry like a current grows on the north shore, but is sparse.

B. "Moss" (probably lichens) about an inch high grows sparsely in places where there is some soil. This may come to the Greenlanders as they eat the gut contents of birds, foxes and hares ~~with~~ <sup>with</sup> ~~gut~~ <sup>gut</sup> contents of birds, foxes and hares.

*("drink")*

C. A low-growing red flower ~~that~~ <sup>that</sup> ~~grows~~ <sup>grows</sup> profusely ~~SA~~ <sup>SA</sup> might reach man via birds, hares, and foxes.

*blowing red fls*

*A low*

D. Arctic willow, the nearest thing to a tree or bush, but very sparse. Only where the sun hits directly is the permafrost ~~reduced~~ <sup>reduced</sup> and even then only to a depth of 6 inches. The ground is rocky glacial moraine, soil minimal.

*melted in summer*

With only these very few sources of food, ~~analysis~~  
*The potential*  
~~of~~ routes of entry of the Pu into ~~man becomes simple. Thus,~~

the Greenlander living around North Star Bay ~~represent the~~

~~not~~ *This minimal*  
focal point of an isolated, small, tightly interwoven food

~~net~~ ~~not~~ ~~is~~ ~~discussed~~ below.

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*removal*  
The seals, the major food item, live on clams, shrimp,  
polar cod, ~~and~~ *The* general detritus *of the bay*, Annex III ~~These~~ animals in

*feed on the*  
turn ~~ultimately consume all types of~~ a zooplankton, ~~and~~  
*and microorganisms*  
phytoplankton. Three species of seals are caught in the area:

the ring seal is  
a) ~~the ring seal is~~ a year-round resident and caught any where;

*becomes too thick for it to maintain a breathing hole.*  
it moves out to the ice flows in the Strait only if the ice  
~~gets more than six feet thick.~~ When one is killed in the Bay,

another moves into ~~its~~ territory, as the Bay is a preferred  
feeding ground. ~~is~~ b) The bearded seal lives year-round

on the edges of ice flows in the Strait; its liver causes  
nausea and is not eaten. c) The harp seal migrates into the  
bay only between June and September and lives elsewhere during  
the rest of the year. Hence where seal meat is concerned, the

worst case is the ring seal. ~~The~~ liver is eaten as a delicacy and  
nutritionally it is ~~the~~ *a* main source of vitamins. ~~The~~

*of Pu in muscle would be low compared to liver, the greater mass*  
muscle ~~energy~~, *provides protein and energy; while the concentration*  
~~probably is balanced by consumption of the large mass of low~~  
*consumed might add to a significant total*  
concentration muscle. ~~In~~ the case of the seal only the PuO<sub>2</sub> put

*would*  
into the Bay, creates a risk. Taking the ICRP value of 3x10<sup>-4</sup> Ci/cc  
of water as the 168 hour acceptable limit ~~for~~ human con-

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sumption, it can be shown that more than all the Pu in the  
weapons could be put into about ~~one-third~~ of one cubic kilometer  
of Bay water. The Bay has about 50 km<sup>3</sup> of water ~~which is~~ *and this is*  
constantly changed by good currents (3 miles/hr), tides and

*and the resulting solution would be*

25

*berg and*  
 melting glaciers, Further the solubility of Pu in sea water  
 is about  $2 \times 10^{-4}$  and if the Pu ~~is~~ <sup>were to be</sup> concentrated by plankton,  
 it is discriminated against by the gut walls of <sup>both</sup> the seal and  
 and <sup>each</sup> man by a factor of possibly  $10^{-3}$  ~~to  $10^{-4}$~~ . For these  
 reasons there would seem to be no hazard to man, but the  
 Danes and we agreed that the gut contents and livers of a  
 number of seals caught during the summer should be analyzed  
 for <sup>Pu</sup> plutonium. The animal <sup>seal would chief</sup> represents the "collection point"  
 for passing Pu on to man, if ~~it~~ <sup>the metal were to</sup> was present in a biologically  
 acceptable form. Also <sup>these</sup> ~~the~~ samples <sup>or would</sup> average out the ~~range~~  
 range of sources and peregrinations of the seals.

assimilable

The migratory sea birds are the second most important  
 food item <sup>to the Greenlander. The birds</sup> live on small fish, shrimps and planktonic

material obtained chiefly from the open waters of the Strait. <sup>When</sup>  
 The <sup>bay</sup> ice ~~breaks up~~ <sup>about</sup> the first part of July, <sup>The birds</sup>  
<sup>begin to feed</sup> ~~However, there is some feeding~~ from the bay <sup>in July and August</sup>  
 or <sup>where ever</sup> ~~and of course~~ the marine life <sup>is most abundant</sup> may move around. It seems highly  
 unlikely that the eggs laid in late June would contain <sup>Pu</sup> plutonium  
 but they will be examined, including the shells. The top  
 fresh layer of droppings at the rookeries will be analyzed for Pu.

The mussels will be examined by analysis of the  
 stomach contents of walrus. <sup>DOE ARCHIVES</sup> Pooled samples of ~~the total~~  
 shell fish collection directly will also be analyzed. Because ~~the~~  
 walrus eats only the foot of <sup>the whole</sup> these bivalves ~~the whole~~ mussel will be  
 should be analyzed since PuO<sub>2</sub> <sup>spec</sup> particles may be lodged in the  
 mantle <sup>and</sup> Soluble Pu incorporated into the mucopolysaccharides  
 of the syphon. <sup>Mussels seem</sup> These ~~seem~~ unlikely ~~to be~~ sources of Pu intake  
 unless the animals concentrate the metal to a very high degree.

Insert from back

Because of the delight of the Greenlander in

(mucopolysaccharides)

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directly eating the <sup>liquid</sup> intestinal contents of birds and animals, the droppings and/or intestinal contents of each of the other animals listed above should be examined <sup>as an indicator of the Pu O<sub>2</sub> present in this part of the food chain.</sup>

The growth characteristics of lichens is ideal for trapping dust and aerosols and samples of these from potentially exposed locations will be analyzed.

In addition, samples of the sea water, bottom <sup>sediment</sup>, ~~bottom animals~~, plankton and detritus, dust, snow and ice cores <sup>will</sup> ~~should~~ be taken <sup>as further information may indicate.</sup>

Finally, analogous <sup>control</sup> samples of the above are to be collected from (possibly) Bylot Bay to the south and the ~~Qanaq~~ <sup>Qanaq</sup> area to the north ~~as controls~~. Control data are required because of Pu fallout from atmospheric testing and because glacial deposits may contain abnormally high amounts of minerals of the uranium and thorium series. ~~Good~~ <sup>Good</sup>

on Kanak

alpha-spectrometry is necessary to demonstrate that the alpha emitter in question is plutonium. <sup>It</sup> All the above ~~was~~ <sup>was</sup> discussed <sup>freely</sup> in detail with the Danes ~~during development of ideas and finally as a package.~~ I saw this as a unique opportunity to

and

examine in quantitative fashion the ecological consequences of siting a reactor in the Arctic, especially as they are considering using a reactor to provide power for mining a huge mineral deposit further south along the west coast. But, as noted above, <sup>the</sup> Danes chose to <sup>conduct</sup> a minimal monitoring-surveillance program based on the data and reasoning <sup>as</sup> outlined. I am still not convinced that they appreciate the meaning and utility of quantitative ecological studies. <sup>The</sup> Danes indicated they would carry out the program themselves so that no one would <sup>raise</sup> ~~the~~ accusations of bias, and they would

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