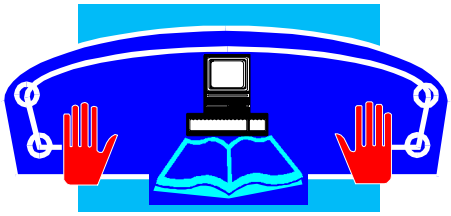


Sachs Harbour Quiviut Spinning Project
Type of Study: Plans/strategies Wildlife Products, Musk-ox
Date of Report: 1984
Author: None Indicated
Catalogue Number: 5-3-3

KP

ARB OUR QUIVIUT SPINNING PROJECT

5-3-3

OBJECTIVE - To begin the development towards a cottage industry in Sachs based on the Quiviut by-product, available from domestic and commercial muskox kills on Ranks Island.

This project represents one phase in the development of an industry. It is anticipated that funding for a second stage to this first phase will be sought at a later date using the information and knowledge developed from this project.

BACKGROUND - Over the past two decades, the muskoxen have been the subject of continued discussion and investigation as to its Quiviut (wool), prized as one of the highest quality natural fibres in the world. Various researchers have looked at the domestication of this animal as the best means of capitalizing on its yearly shedding of Quiviut.

This is no idle fantasy. Adult muskoxen shed five to seven pounds of Quiviut each spring - compared to the meagre output of the cashmere goat (4 - 12 ounces).

The Alaska Co-Operative, Qomingmak Muskox Producers Co-Op, has a domesticated herd of 120 - 130 musk oxen which are combed out annually. The Quiviut is sent away for spinning, and the yarn then knitted into scarves and toques in six Inuit communities, by over 100 knitters. Finished goods are resold by the Co-Op and produce over a quarter of a million dollars in retail sales.

The people in Sachs Harbour, who have access to up to 2000 animals as a kill quota, or the 20,000 or so animals as a live resource, see tremendous potential for the herd.

.../2

Over the past four years, the Sachs Harbour H. T. A., in collaboration with the Inuvialuit Development Corporation (IDC) and Renewable Resources, GNWT, have been refining their field kill and slaughter techniques while providing meat for sale through IDC's arm, Ulu Foods. The H.T.A. sees the Quiviut as another potential source of income. Ideally, the Quiviut could be collected off the hides from the annual kill.

Otherwise, there may be the possibility of collecting Quiviut from live, wild animals. The Department of Renewable Resources will assist in the examination of this possibility, and look at some experimental collection techniques.

In the meantime, the ladies of Sachs Harbour are strongly interested in learning how to use the Quiviut now available. Skills developed now, on the small scale development of this resource, will be critical to the future development of a larger-scale cottage industry.

PROPOSAL - This proposal may be called the first stage of the commercial development of Quiviut. Two sessions are proposed in developing this, in a workshop setting, which would train the participants in the skills to clean, card, spin and knit or crochet the Quiviut into garments.

Session 1 - July, Sachs Harbour

Inualthauyak School - 4 days

- practice spinning of sheeps wool
  cleaning and carding of Quiviut
- practice spinning of Quiviut
- demonstration of knitting and crocheting of small items
- introduction to dyeing

.../3

Session 2 - October, Sachs Harbour - 4 days
review of spinning skills
knitting and crocheting of special items, toque, scarf, vest

NOTE: After each session, Jackie Kuptana, who has some skills in knitting, will assist ladies who need further training and practice.

The Inuvialuit Development Corporation in Inuvik will turn over its supply of raw Quiviut to the Sachs Harbour H.T.A. for use in this project. This material was obtained from Quiviut and hair slipped from hides in an earlier test project. The Quiviut obtained from the cleaning and separation process will provide Quiviut for the Sachs Project as well as identify the quantity of effort (and thereby information on cost) required for the process.

The information gleaned from this project will add to the database now on hand and will be crucial in the long term to identify the commercial viability potential to Quiviut.

SESSION 1

MATERIALS AND SUPPLIES

Spindles	3.00	
Dye Book	16.00	
Machine Oil	2.00	
Ammonia	1.00	
Reference Material	10.00	
theel;'s Wool	25.00	57.00

INSTRUCTOR'S FEES

6 days @ 100.00	600.00

ROOM & BOARD

6 days @ 37.25	223.50

SCHOOL USER FEES

4 days @ 75.00	300.00

TRANSPORTATION

Air fare - Whitehorse-Inuvik-Whitehorse	587.00		
Inuvik-Sachs-Inuvik	356.00		
Freight charges - Quiviut from Inuvik to Sachs - 100 kg @	1.65	165.00	1,108.00
		Total	2,288.50
		Contingency allowance	111.50
		TOTAL	2,400.00

SESSION 2

INSTRUCTOR'S FEES

6 days @ 100.00	600.00

ROOM & BOARD

6 days @ 37.25	223.50

TRANSPORTATION

Airfare - Whitehorse-Inuvik-Whitehorse	587.00		
Inuvik-Sachs-Inuvik	356.00		
		Total	1,766.50
		Contingency allowance	88.50
		TOTAL	1,855.00

PROGRAM

APPLICATION OF FUNDS

Session 1	$ 2,400.00
Session 2	1,855.00
	$ 4,255.00

SOURCE OF FUNDS

Sachs H.T.A.	450.00
E.D.A. Contribution	3,805.00
	$ 4,255.00

NOTE: Value of raw Quiviut is also input by the Sachs H.T.A. but is not given a value factor in the financial program. The $450 .00 cash equity is from sales of Quiviut by the University of Saskatchewan from muskoxenownedby the Sachs H.T.A.

PARTICIPANTS

Thefollowing women have shown interest in the project andhave indicated theywill attend the workshop:

Lena Wolkie	Florence! Nasogaluak
Betty Haogak	Diane Carpenter
Beverly Amos	Annie Rose Goose
Agnes Nasogaluak	Margaret Elanik
Doreen Carpenter	Rita Carpenter
Anita Pokiak	Samantha Lucas

191 Valleyview Dr.
Whitehorse, Yukon
Y1A 3C9

June 8, 1984

Dear Jackie;

Further to our phone conversation of June 5, 1984, I am enclosing an outline for the proposed eginners workshop. Any suggestions for changes or amendments would be carefully considered as I would like this worksh p to meet the specific needs of this group.

According to the best information we can get here regarding Ken Borek Air and its connections with TNTA this is the most acceptable itinerary:

TNTA: lv. Whse wed. 9:00 am
arr. Inuvik wed. 3:25 pm
Ken Borek Air:
lv. Inuvik Thur. 11:30 am
arr. Sachs Harbour Thur. 2:15 pm
Workshop, Fri., Sat., Sun., Mon. morn.
Ken Borek Air:
lv. Sachs Harbour Mon, 2:00 pm
arr. Inuvik Mon. 4:00 pm
TNTA lv. Inuvik Wed. 4:10
arr. Whse. Wed. 8:10

I hope a weekend workshop is acceptable.

I will bring a large box of qiviut and hair which Ulu Foods sent for experimentation. If you can arrange for a hide then we can see method of harvesting the qiviut is better from the spinners point of view. Should I also bring knitting needles? Sizes 8 to 12 or their metric equivalent would be the best.

Finally, is there anything I can bring you and your family from Whitehorse?

I look forward to hearing from you with regard to dates in July.

Sincerely;

Jackie Saunders

cc. Lloyd Binder

BEGINNERS WORKSHOP

QIVIUT PREPARATION AND SPINNING

DAY 1. 9:00 - 4:00 with 1 hour lunch break

INTRODUCTION

SAMPLES: -Hunter's and Trapper's Assoc. hide
-Ulu Foods qiviut and hair slipped from hide
-clean fibre
-spun fibre
-knitted fibre

PREPARATION:
-comb out of hide
-seperate qiviut from hair
-remove dandruff, twigs, etc.
-grade quality
-wash
-tease
-card (I have ordered cotton carders from San Fransisco)

Each participant will be expected to have about one ounce of prepared qiviut ready for the following morning.

DAY 2 9:00 - 4:00 with 1 hour lunch break

SPINNING: Each participant will be given a stick spindle to begin spinning. It is easier to grasp the fundamentals on a spindle than on a wheel where a person cannot actually see what is happening.

-importance of twist
-importance of drawing out
-using medium quality demonstrate spinning
-help each participant to get started
-practise

Lunch Break

-prime quality, spun fine
-poor quality spun much thicker
-demonstrate use of Ashford wheel
-rotate participants on wheel while others continue on spindles
-plying

DAY 3 9:00 - 4:00 with 1 hour lunch break

Practise spinning and help with any problems participants may be having.

DYEING: A brief introduction to dyeing with lichens which will be dealt with more thoroughly in the October workshop. It would be best, however, to collect the materials in the summer.

-samples of dyed qiviut
-samples of lichens
-dye book, McGrath. Dyes from Lichens and Plants

FIELD TRIP: take lunch, knife for scraping and many bags
-are there lichen covered rock surfaces near town?

-return to classroom
-method of fermentation
-spinning practise if time allows

DAY 4 9:00 – 12:30

-review spinning
-help with problems

KNITTING: how much we do here will depend on how well the spinning has progressed

-xeroxed instructions
-demonstrate cast on, knit, purl, cast off.

ADVANCED WORKSHOP

I will write a more detailed proposal for the October workshop after I see the progress made in the beginners workshop.

SPINNING: Help each participant improve her skills in spinning fine, medium and thick yarn.

DYEING: Demonstrate and teach the actual methods of dyeing with fermented and boiling water lichens. Demonstrate and teach the use of indigo, the only reliable source of natural blue dye.

KNITTING; Help each participant improve her skills with the basics. Teach some lace patterns, open work patterns and methods of shaping.

WENDY CHAMBERS
WORKSHOP INSTRUCTOR

Per Diem Rate: $100.00

Additional Costs:

Transportation:	Whitehorse-Inuvik, return Inuvik-Sachs Harbour, return
Accommodation:	Inuvik, 2 nights Sachs Harbour, 4 nights (will camp if weather permits) ---
Meals:	Inuvik, 2 dinners, 2 breakfasts Sachs Harbour, all meals
Supplies:	1 spindle for each participant - $3.00 ea. telephone calls to order supplies - 10.00 1 dye book - $16.00 Knitting needles -purchase by participants optional sewing machine oil for spinning wheel -$2.00 ammonia for lichens -$1.00 xeroxed material -$10.00

CURRICULUM VITAE

Name: Wendy Rona Chambers

Address: 191 Valleyview Dr.
Whitehorse, Yukon
Y1A 3C9

Personal Data:
Birthdate: July 19, 1943
Marital Status: Married
Children: Two
Weight: 140 lbs.
Height: 5' 10"
Health: Good

Interests: Spinning, weaving, dyeing and other fabric arts, cross country skiing, hiking, gardening and reading.

Education:
B.A. Class I. 1965, University of Victoria
Majors: Anthropology, Sociology and Psychology
B.L.S. Class I, 1969, University of British Columbia

FibreArts Experience:

Spinning :12 years of experience
:self-taught
:special interest in wool and muskox qiviut
:other fibres used include dog hair and angora
:taught workshops and given private lessons in B.C. and Yukon

Natural Dyeing:
:12 years experience
:taken workshops from Joanne Staniszkus and Michele Wipplinger
:special interest in lichen dyeing
:other natural dyes both substantive and adjective
:taught workshops and private lessons in the Yukon and B.C.

Weaving :6 years of limited experience
:taken workshops from Katherine Dickerson, Inese Birstins and Lily Bohlin
:special interest in colour and texture from handspun yarns

Knitting :12 years experience
:self-taught
:special interest in knitting handspun dyed wool into multi-coloured patterns and qiviut in open and lace patterns.

Other related experience

:correspondence with the university of Saskatchewan Muskox project regarding the quality and marketing of qiviut. 1983

:consultation with Ulu Foods, Inuvik regarding processing and quality of qiviut. 1984

:"Qiviut" The Heddle. vol. I, no.2, Summer, 1984, p.12.

:retailing of handspun wool and qiviut items through Touchstone, P.O. Box 1754, Yellowknife, N.W.T. 1983-

:research on the "Cowichan Knitting industry" for the Vancouver Centennial Museum. 1970

Memberships

:Victoria Weavers and Spinners Guild, 1971-1978

:Whitehorse Weavers and Spinners Guild (now Nothern Fibres Guild), 1977-
President, 1981-1982.

:Ponderosa Fibre Artists Guild 1982-

:Mariposa Fibre Artists Guild 1982-

:Canadian Guild of Handweavers 1979-

:Handweavers Guild of America 1982-

:Advisory Board, The Heddle 1984-

HUNTERS AND TRAPPERS ASSOCIATION
Sachs Harbour, N.W.T.

April 26, 1984

Jackie Kuptana
Workshop Co-ordinator
Sachs Harbour, N.W.T.
X0E 0Z0

Dear Jackie,

Thank you for presenting a verbal outline of your proposal for a possible workshop to learn to spin, knit and crochet qiviut (muskox wool).

As the muskox on Banks Island are one of our main renewable resources, the Hunters and Trappers Association give their full support for your proposal and hope that a cottage industry can be developed in this community, in the near future.

Yours truly,

Samantha Nicholas

for Peter Esau,
President, H.T.A.
Sachs Harbour, N.W.T.

c.c. Economic Development
GNWT, Inuvik. c/o Lloyd Binder

Qiviut—handle spinning chores with care.

By **Wendy Rona Chambers**
Kaleden, B.C.

It is good news to read that the University of Saskatchewan through the Prairie Lily Weavers is now grading and marketing qiviut.

This outlet plus Ulu Foods of Inuvik who are also starting to market qiviut means a limited but steady supply will at last be available to handspinners.

Because of the hitherto scarcity, few people have had the opportunity to try this wonderful fibre and fewer yet have developed any expertise.

Through a lot of luck and a little persistence during the past few years, I have succeeded in obtaining various batches of qiviut from research animals, game farm animals and wild animals. Although there are many questions still to be answered, experience with this assorted lot of fibre has given me a basic knowledge which may help others about to attack their first bag of qiviut.

The fine wooly underhair of the muskox is similar in physical characteristics to cashmere and has often been likened to silk.

It is approximately eight times warmer than wool, is very strong, lacks crimps and therefore elasticity but has a pronounced loft or bounce and it does not shrink or felt. When carefully considered these characteristics suggest a finely spun yarn with sufficient twist to hold it together, worked into a finished product that is lightweight, airy and extremely warm.

Before starting to prepare the **fibre for spinning, the' quality of it must be considered. There is** *qiviut and then there /s* **qiviut.**

The finest quality is that which

PRODUCT POINTERS

(for although it does not felt there is no point in scrambling the fibres any more than necessary) and sufficient rinsing to remove all soap.

When the qiviut is dry pick out all hair and foreign matter - including any dandruff or dry skin attached to the qiviut. Muskox have yet to be introduced to "Head and Shoulders" and dandruff can cause more problems than the coarse guard hairs.

If the white bits of skin are scattered through the qiviut it is virtually impossible to remove them. The resulting yarn will be speckled and uneven.

Reluctant though I am to take scissors to any natural fibre, it is the only satisfactory way of eliminating the dandruff. Snip - it is gone.

Now begin picking the foreign bits with fingers or tweezers. Gently separate the fibres sideways so they will draw out smoothly during spinning.

At this point carding the qiviut would improve its spinning qualities but even the finest wool carders produce too many "pills" in the rolag. More finely set cotton carders are required but attempts to obtain a pair have so far been unsuccessful.

After preparing a, mixed lot of qiviut, your hands more than your eyes will tell *you* which is finest quality and which is not. The finest quality has a smooth silky feel uninterrupted by criss-crossed fibres and coarse hair. It can be spun into a gossamer thread, one

a chopstick, pointed at both ends with a weighty piece of clay, bead or even bushing near the bottom point. All you disbelievers think of the millions of miles of fine cotton and siik that has been spun on this humble stick over the centuries.

it cannot be the awkward, primitive, device we assume and in fact, it is not. Even a beginner can keep pace with a wheel and with a little practise go much faster. One quick twist of the stick results in many more, revolutions and therefore twists than the turn of a spinning' wheel.

The stick does not dangle at the end of the thread, but as the name implies, it is supported. Traditionally a gourd was used but a bowl will suffice.

Attach a long piece of yarn to the stick above the weighted end. Run it up the stick to the point. Take a handful of picked qiviut and draw out some to overlap the tail of yarn coming 'off the point of the stick. Give the'sticks quick twist and wait for the qiviut to firmly twist onto the leader.

Now begin drawing out the qiviut as the twist runs up. When a sufficient length has been spun change the angle of the yarn and twist the stick *to* wind it on.

This is a portable and affordable **piece of equipment. The latter being important since the cost of qiviut can easily empty your pocket.**

The *poorest quality qiviut is easy*

garment which is noticeably lighter and fluffier than one woven with a wool weft.

With the finest and poorest quality sorted out, all the fibres which remain are of medium quality. They can be spun into a nice two piy yarn, the weight of which will be determined by the project.

You will find that the qiviut compared to wool will require a shorter draw and more twist. The characteristic loft becomes evident when the singles are plied and the resulting yarn triples in diameter.

Due to its lack of elasticity, qiviut does not ply in the same manner as wool. The singles often iie side by side rather than twisting around each other. This is particularly evident if the singles have been left to sit too long on the bobbin.

Spin about one haif ounce on each bobbin or whatever can be spun in a day or two and ply with a good twist. Dampen the skeins and hang to dry without weight to set the twist.

The tactile beauty of qiviut will continue to entrance spinners. However, as processing the finest quality yarns employs few or no mechanical aids and requires 10 or 15 times as many hours to spin as a similar weight of fine wool its production will be limited. Consequently, whatever is spun should be of the highest possible standard that the quality of fibre will allow.

It is encouraging to note that the two current suppliers previously mentioned, Ulu Foods and Prairie Liiy Weavers have recognized grades in quality and are seeking to set their prices accordingly.

Spinners can assume some responsibiliit y for educating the

fibres are aligned. The coarse guard hairs are few and ideally there are no flecks of dandruff clinging to the skin end of the fibres.

Qiviut gathered from the tundra or game farm after it has been shed has to be considered lower quality, not because the fibres themselves may be in any way inferior but because they are in such disarray. These fluff balls are filled with bits of straw, lichen, twigs and dust.

In the same category are tufts which I suspect come from lower down on the body of the muskox and/or have been shed later in the season. This qiviut has a higher percentage of fine hair than the shoulder quality which is more difficult to distinguish at first glance.

It is here that the buyer must beware. While this looks like a fluffy mass of qiviut and has nearly always commanded the same price as finest quality, it is definitely of less value. Removal of all the hair is extremely time consuming and will result in a considerable loss of weight of usable fibre.

On the other hand, if the hair is left in and spun with the qiviut the result will be a scratchy yarn, not the fabled cashmere soft result you anticipated.

The time spent in careful preparation will be amply rewarded in the quality of spun yarn. Extremely dusty or musky smelling fibre can be washed before picking. Do not be alarmed when a large bag of qiviut emerges from the water a mere soggy handful. It will recover its loft when dry.

Wash as you would any fine fleece: gentle soap, gentle action

wool wheel is very slow as the tension must be reduced to almost nothing in order to get the right amount of twist into the thread.

A speedier alternative is the supported stick spindle - *no* bigger than

It can be spun into a "heavy single" of about the same thickness as a Condon's two ply, suitable for weft in outer garments or items not worn next to the skin.

Even this poor quality will pro-

Addresses of suppliers:

Prairie **Lily Weavers, No. 39-1736 Quebec Ave. Saskatoon, Sask. S7K 1V9**

Ulu Foods, Box 2000, Inuvik, N. W. T., XOE OTO

This was written by Alaska (Fairbanks Spinners & Weavers Guild) and is very good information on all aspects of fiber production

THE MUSK OX

The Fairbanks Weavers and Spinners Guild from Alaska was represented at Convergence '82 with a most impressive educational display based on the Musk Ox and its underwool. Our grateful thanks to Dannette (Penny) Wakefield, who collected the following information from several sources, including herself, to give us a comprehensive view of the fiber, the workshop, and the exhibit. —ed.

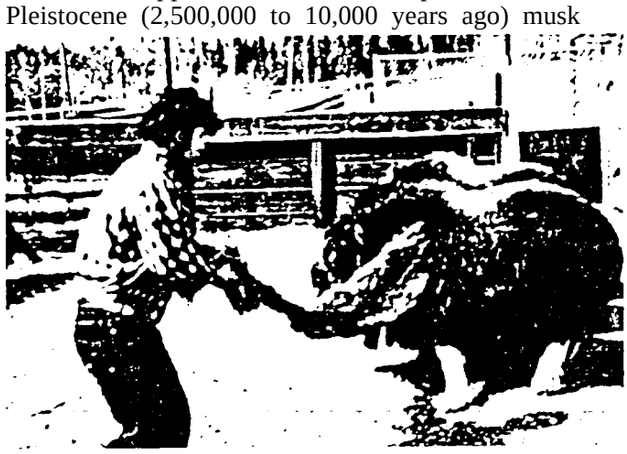
Also, see "Summary of Wool Bureau Report on Musk Ox Fiber" on page 42

1982 was the 30th anniversary of the Fairbanks Weavers and Spinners Guild and the workshop was part of a series of activities that we did through the year to celebrate our thirty years. One of the things that made it special, was that the lady who founded the guild in 1952, Lydia Fohn-Hansen, was also one of the first people to experiment with musk ox fiber in spinning when she first came to Alaska and worked with the University. She is 91 years old, lives in Lacy, Washington, and still does spinning demonstrations and spins musk ox yarn to be used on the inside of mittens. She gave many people musk ox to spin when she was receiving it from the Eskimo ladies who would go out and gather it off the bushes on Nunivak Island from the wild herd. We would appreciate these articles being dedicated to Lydia Fohn-Hansen for founding the guild and maintaining everyone's interest through the years.

Name
Musk ox, L. *Ovibos moschatu* 'musky sheep ox")
Order: Arctiodactyla Family: Bovidae
Subspecies: *Ovibos moschatus wardi, O. m. moschatus, O. m. niphoecus*
Notes: 1. In 19th century also called "musk-buffalo", "musk-sheep". 2. Only one species recognized by some authorities. 3. Musk oxen do not produce musk, and are not closely related to sheep or cattle.

Populations

The world population is between 17,000 and 23,000. Wild populations occur naturally in Greenland and Northern Canada, particularly in the Arctic islands. Transplants have been made from Greenland to Norway, Spitzbergen, and Alaska, and unsuccessfully to Sweden and Iceland. Few zoos have musk oxen. The U.S. has given a few head to China and Russia. The latter have been released on the Taimyr Peninsula and Wrangel Island and appear successful in reproduction. In Pleistocene (2,500,000 to 10,000 years ago) musk



Fleece being removed from musk ox. PHOTO BY HELEN HOWARD

oxen were in the Kansas/Kentucky latitude, in Europe and parts of Siberia.

Physical Characteristics

Robust, buffalo-like ruminant, **4-5** feet high at shoulder. Bulls normally weigh 450-680 pounds, cows lighter. Massive skull, short neck, very short tail, stocky legs The horns are extremely broad at the base, especially in adult males, in which they almost meet in the midline, forming a heavy boss. They curve downwards at the sides of the head, then upward and forward at the tips, and are Up to 2 feet long. The eye projects about 2.5 inches from the side of the head, which permits vision beyond the bulky hair coat. Beneath guard hairs of 18-26 inches grows a soft, fine underwool, up to 6 pounds, shed April to June. Cows shed after parturition. Both sexes have four teats, rudimentary in bulls. The female's udder is small, densely covered with hair, and the teats are 1.5-2 inches long. Bulls emit a characteristic odor during breeding season.

Social Habits

Musk oxen are sedentary animals, but will on occasion travel long distances Groups may consist

Examples of guard hairs and underwool, a shedding musk ox

of up to 30 animals of any age or sex. Breeding bulls collect a harem of up to 10 cows. Immature males form small groups on their own. Older, non-breeding bulls may wander alone or in small groups. Gestation period is about 8 months, and calves are born April-May, weighing about 22 pounds at birth. Calves run with mothers about 15 months. Duration of lactation varies with nutrition. Weaning may occur in September or much later (e.g., 18 months). Under domestication, calves are weaned earlier and cows are bred annually. When attacked, a musk ox herd forms a circle with the young animals in the center and the horned adults facing outward. This affords adequate defense against wolves, the chief natural enemy, but against men armed with rifles it merely renders easy the annihilation of the herd. In snowstorms musk oxen will lie down and be completely blanketed except their blinking eyes. Against strong Arctic storms and blowing snow, bulls and older cows will stand head-on to the tempest in an aerodynamic V-formation protecting the younger animals between them. Musk oxen are ruminants, and eat grass, moss, sedges, and shoots and leaves of dwarf willow, etc. In winter they dig through the snow when it is not solidly iced, They cannot tolerate deep snow,

Penny Wakefield (in the hat) and part of the Musk Ox exhibit PHOTO BY LEE RAVEN

qiviut (kē'vē oot') n. (Esk) 1. :he free, soft, light-brown under layer of hair on the musk ox 2. yarn spun from this hair.

- Unscoured raw stock has 6 8% grease; wool has 20°/0 grease.
- Approximately 200/0 by weight is lost to guard hairs and unspinnable fibers.
- A *4/6* woven sample has the tensile strength rating of 70 (p.s.i.); wool women's wear is rated at 20 and men's at 40.
- It is approximately eight times warmer than wool.
- It has similar physical characteristics to that of cashmere, although the fiber is somewhat larger,
- Because of the lack of crimp and scales, it has almost no elasticity and does not felt or shrink.
- Commercial spinning oils can cause rapid color deterioration.
- Dry cleaning will not harm the fiber,
- It will fade to a yellowish brown with time and will age in weather and become harsh and brittle.
- In very low humidity it will not change color, but can produce a harsh hand.
- It has a smooth, soft, silky hand and weaves up beautifully even though it can be somewhat slippery m the warp

History

Eskimos have used musk ox horns for ladles, bones for sleds and implements, hides as bedding, and used the guard hairs to make mosquito nets, The musk ox was first mentioned in print as "buffalo" by Canadian Henry Kelsey, in 1689. The first real description was by a French frontiersman, Nicolas Jeremie, m 1708. Living at Fort Bourbon (later Fort Nelson), he described musk oxen, calling them "boeufs-musquez" -". because they smell so strongly of musk, that at a certain season of the year it is impossible to eat them. " Later explorers agreed, and suggested that even young animals had tainted flesh. There has been disagreement about the smell, but it may come from the postorbital gland. Bulls often rub their nose on their foreleg as a threatening gesture.

Little was known m the 19th century about musk oxen, except from their bones. Intensive hunting between 1852-1916 produced 15,000 hides for carriage robes, soid through Hudson's Bay Company. Arctic explorers, whalers, and Eskimos killed musk oxen for food. In some regions they were exterminated. In 1917 Canada protected them, and established a sanctuary of 15,000 square miles.

In 1930 the United States brought 34 musk oxen from Northeast Greenland to Alaska. For six years they were on a 40-acre pasture near Fairbanks. They were then removed to Nunivak Island, where they increased to 450 by 1964, 750 in 1969.

Domestication of musk oxen had been proposed by a number of Arctic explorers, particularly Vilhjalmur Stefansson. From 1954 to 1964, John J. Teal, Jr. studied six musk oxen at his Vermont farm Then in 1964, as president of the Institute of Northern Agricultural Research, he organized capturing expeditions to Nunivak Island and established a domestication program at the University of Alaska, The seed stock consisted of 10 male and 24 female calves. A program of selective breeding began, together wrth intensive human contact, to produce a tame domestic animal. The underwool (trademark Qiviut) was collected annually, and sent off to be commercially spun. The Qiviut was used for a cottage knitting industry among Eskimo villagers, who formed a cooperative, Oomingmak, the Musk Ox Producers' Cooperative. In 1976-77 the herd was moved from the university to the coastal village of Unalakleet.

In 1979 the Institute of Arctic Biology captured 10 musk oxen on Nunivak Island and established a biological research program on the same land at the university as had been used by Teal's domestication program,

The Alaska Department of Fish and Game, and the U.S. Fish and Wildlife Service, have transplanted wild musk oxen from Nunivak to Nelson Island, the Arctic National Wildlife Range, Cape Thompson, and the Seward Peninsula.

Other domestication programs have been initiated with John Teal's help in Fort Chimo, Province of Quebec, Canada, and in Bardu, Norway. The Bardu musk oxen have recently been shifted to the Department of Arctic Biology at the University of Tromsö for biological research.

Musk ox on open range of treeless Nunivak Island PHOTO BY HELEN HOWARD

Musk ox textile history

Other than the use of the long guard hairs and the hides by the Eskimos, the first recorded use of the underwool was when Jeremie brought some back to France and had it made into stockings, which he described as "more beautiful than those made of silk", in 1708. Though some arctic explorers picked up wool from the tundra, it was little more than a curiosity. Stefansson's expedition of 1913 -1918 and Capt. Henry T. Munn brought musk ox skins south from Baffin Island. The underwool was combed from them (which produced a large amount of guard hair also), Fifty to sixty pounds of wool were obtained and sent to different processors in Canada, but little interest was shown as it did not seem commercially possible to separate the guard hair from the underwool

Forty pounds of combed wool were sent to Leeds University, England, This provided Frank

H. D. Atkinson with data for a Master's thesis in 1922. The wool was processed on available commercial machinery set for a 36's-40's quality wool. Various weights of roving were produced, and hosiery and weaving yarns were spun. Atkinson found:

1. The fiber is more nearly a hair than a wool fiber.
2. Consequently does not possess any marked scales or serrations with a free or projecting edge.
3. Lack of waves.
4. Comparative straightness of fiber.
5. Apparent lack of gelatinous substance in the interstices of the scale structure.

(Atkinson, 1922, p. 25)
(see Schell, 1972, Master's thesis)

Atkinson found musk ox wool to be more suitable for knitting than weaving. The guard hairs were a problem, and tickled the wearer of socks or clothing.

A suit-length was woven from the musk ox wool, and presented to the King of England in 1933. A similar suit was made for V. Stefansson, in whose closet it was carefully hung. Years later his second wife was sorting out clothes for the Salvation Army and happened to come upon it. Thinking that he no longer wore that particular suit, she included it in the contribution. Perhaps somewhere there is a tramp clad like a king!

In 1931 Werner von Bergen, chief chemist for the Forstmann Woolen Co., received musk ox underwool from the Fairbanks herd newly arrived from Greenland. He compared it with cashmere, finding it essentially freer than cashmere by a couple of micrometers. It averaged 11.4 -15.3 microns. Von Bergen also compared the wool of *O. m. moschatus* from Canada (Atkinson's sample) and O. *m. wardi* from the Alaska herd. He noted that the difference was merely in color, the former being brown, the latter grey. Von Bergen enthusiastically stated: ". . . it is my belief that the musk ox wool hair, growing on the shoulders of the animal, is the freest wool hair which is known today. I am convinced that the musk-ox wool will become a valuable commercial product after domestication. " (Von Bergen, 1932, pp. 9 & 11), (see Schell, 1972).

In 1933 wool was given to Mrs. Lydia Fohn-Hansen of the Extension Service at the University of Alaska, "to use as she thought fit". She organized students of the Home Economics department into spinners and weavers, and they produced scarves on a worsted warp with musk ox filler, which sold from $4 to $10 each. Weavers were paid $2.50, spinners $.50 per ounce. By 1943 $708.24 was realized from sales, a $2 profit over expenses.

In 1958 John Teal sent the wool from his six Vermont musk oxen for processing on the special machinery designed to remove guard hair and beard hair from cashmere, The Forte' Cashmere Company spun a 2-ply, 6¼-run yarn, bleaching a small amount of it. The Hadley Corporation knitted three sweaters from this beautiful brown wool, trimming them with the fine bleached yarn.

In 1965, from the recently established herd at the University of Alaska, Teal sent Qiviut to Mrs. Dorothy Reade, Eugene, Oregon. She combined it with many natural and synthetic fibers and researched it very thoroughly, giving her opinion that among all known fibers "not *one* of them combines so many excellent features",

In December 1968 Mrs. Lillian C. Schell, Textile Specialist of the Musk Ox Project, visited the village of Mekoryuk on Nunivak Island and taught nine Eskimo women to knit a Qiviut scarf with a design in the center based on a 1200-year-old ivory harpoon head's design markings. She used a graphic stitch notation dewsed by Dorothy Reade, which could be followed by non-English speakers who could not read. The first few scarves were knitted of 4-ply 1 l-run, followed by 2/11 when the design was changed to a 3-repeat overall lacy pattern. These scarves originally sold for $50. Similar scarves these days may be purchased from Oomingmak, the Musk Ox Producers' Cooperative, 604 H Street, Anchorage, for $115. The Qiviut comes from the Unalakleet herd and is spun by Forte' Company in weights of 2/3 and 2/6. Oomingmak's 150 Eskimo knitters also make hoods, caps, tunics, baby bonnets, stoles, etc. At one period sweaters were made to order, and Qiviut was dyed in CIBA Kiton. A striped beret was made with dyed and natural Qiviut, and garments were produced in various smoky colors. Kyo Currier and Fran Reed studied the potential of dyeing the fiber. Bleaching has been done commercially, but was found to endanger the handle and strength, unless done carefully.

In 1970 a similar knitting program was begun in Fort Chimo, Canada, where the Eskimos were taught by Helen Griffiths, a member of the Alaskan project. In Norway, the Bardu musk ox herd provided Qiviut for local women's independent textile production.

On Numvak Island many of the Eskimo women have spun musk ox wool picked off the bushes on the tundra using no spindle. They spin with their fingers in the same method as they traditionally have used to make thread from sinew The resulting yarn is a soft two-ply.

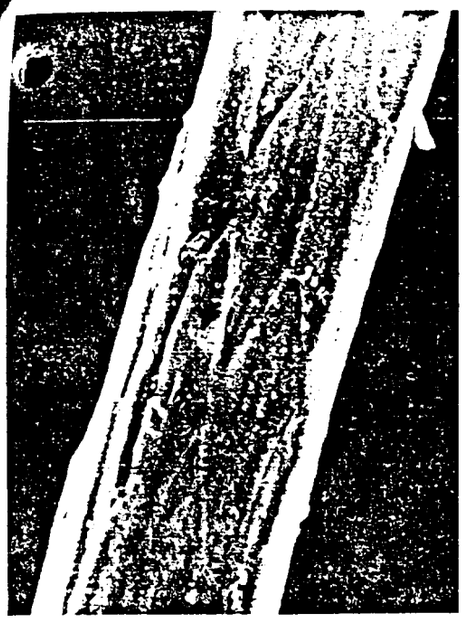
The above information was compiled and summarized by Helen Griffiths Howard, who at one time worked with the original musk ox project.

Musk Ox Available

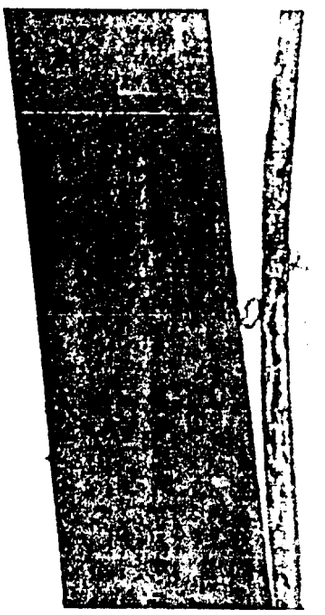
There will always be only a limited supply of musk ox fiber available for spinning, because most of the fiber is used by the Eskimo knitters for the cooperative But the existing animals belong to the state and the people, so at least for a while, there will be some available for hand spinning. All one has to do is write for information regarding the current price for musk ox to

Institute of Arctic Biology
Musk Ox Research—Dr. Robert White
University of Alaska
Fairbanks, Alaska 99701

They will be selling again sometime this spring but write for information soon, for it will go fast



Scanning electron microscopy of musk ox guard hair (left) and underwool (right) 880x Photos by Mary Ann Borchert, Geophysical Institute, University 01 Alaska



Light microscope photo of musk guard hair and underwool for size comparison (69×). Photo by Fran Reed.

Some Hints on Spinning Musk Ox Wool

by E. Marguerite Cornwall

It was during the late 1960's in eastern Canada that handspinning first became a part of my life and it was soon afterwards that an article in *The Beaver* (published by the Hudson Bay Company) first brought my attention to musk ox wool. What a wonderful fiber it sounded to be, and what fun it would be to try some! Little did I realize that within two years I would be living in Fairbanks, Alaska, and spinning musk ox wool to my heart's content. Although the Musk Ox Cooperative was here in Fairbanks, we could not obtain any of the fiber from them, so what was available came from a wild herd on Nunivak Island. One of the native ladies would go about the island gathering the shed fiber from the rocks and bushes on the island and send it to one of Fairbanks' old-time spinners, Lydia Fohn-Hansen. She in turn was most willing to share with other spinners so they could use it in spinning demonstrations for tourists to the area. In this way, I have been fortunate to have spun several pounds of fiber over the years, and when one considers its rarity and freeness, several pounds is a great deal. It is indeed a wonderful fiber and has certainly lived up to and beyond my expectations.

When it was apparent that some fiber would be available through a project at the Institute of Arctic Biology at the University of Alaska, Fairbanks, the Fairbanks Weavers and Spinners' Guild asked me to teach a workshop in musk ox spinning. We first did a mini-workshop for Guild members so that they could write proposals and produce articles in musk ox wool in time to have a show ready for a larger national workshop in Fairbanks, and shortly after for a display at Convergence '82. The notes which follow are some pointers from those work shops. They assume some basic knowledge of spinning techniques and wheels but not a great deal of experience. Since the fiber is exceptionally fine, the concentration is on fine yarn spinning. It seems a waste if one spins too heavy a yarn with musk ox wool for its rarity encourages us to conserve, and its inherent characteristics of fineness, fluffiness and ability to retain moisture, mean that bulk is not necessary for warmth.

The successful spinning of musk ox wool depends primarily upon a careful selection and preparation of the fibers to be used. In my experience there has been a wide variety in the quality of fibers available, ranging from 50% guard hair to batches with 98% usable down. If you have any control over the price you pay, be sure to take the estimated weight loss into consideration. Whenever the fiber has been available, the price variations have reflected this factor, although I have had some exciting barters with biologists who have come in from the field with fiber to sell.

Cleaning

The finer or softer the yarn to be made, the more discriminating you should be in grading the fiber. There seem to be three distinct types of fiber which holds true in most of the lots that I have seen. First and most obvious is the long very coarse guard hair. Eliminate these completely. Some of the guard hair is a little shorter and finer but still has the characteristic stiffness that will cause it to poke out of the spun yarn and be

scratchy The second type of ' 'er is much freer and tends to be curly at one e.. and straight at the other. Although the word "kemp" has been applied by some to this fiber, it is not really kemp as you would find m sheep's wool. These medium weight fibers could be included m the finished yarn as long as that yarn is not to be too free, and you are not concerned with the ultra softness as is obtained from using strictly the downy fiber. The third and most valuable type of fiber is the down—that soft cloud which renders the musk ox wool so lightweight, airy and warm. It is these fibers which you want to cherish and separate out in order to obtain the softest of the soft yarns no matter what the weight of yarn that is to be spun.

When you receive musk ox wool, it can be m a variety of conditions. If it has been taken directly from the animal as soon as it is ready to be shed, it tends to be in large sheets of togetherness, not a whole fleece as from sheep, but in easily managed sections which make sorting and grading more rapid. If there is any sign of dandruff (thin white flecks) on the surface or skm-side, it is best to remove these first. (1 have found these on mountain goat wool also.) The fastest way is to take a pair of curved scissors and snip the dandruff off. If it is broken up by the sorting of the fiber, it tends to divide into many small bits and remain clinging to the yarn even after plying and washing. The long guard hairs, if seen poking out through the surface of the batch, can be pulled out through the top without separating the mass. It is easy to see them and easy to slip them [his way The second grade of fiber can then usually be pulled downwards and out leaving the fine down. Now the down should be slowly and gently separated sideways. Have a light-colored cloth on your lap and a good light over your shoulder. Hold the fibers so that you can see through the thin layer and, using your fingers, or a pair of tweezers, pull out any coarser fibers that remam You will notice that the coarse fibers will spring up when this slight sideways ten. ion is released.

In many cases, this latter step is the only one possible. If the fiber has been gathered m the field after it has been shed by the animal and blown around by wind and ram, it is no longer in any order. It is not m sheets but m tufts which can contain any amount of foreign matter, twigs, lichen, guard hairs, etc. When it is m this condition, you must simply tease and separate the fibers mto thin layers and extract the unwanted elements. It may also be more difficult to distinguish between the medium and superfine fibers. When purchasing this type of fiber, do try to pay a lower price because not only will you have a higher percent of weight loss, your time used in preparation will be much greater. All of this may sound terribly tedious and slow but if you truly wish to see the quality of the down it is necessary and extremely valuable Avoid the idea of leaving the coarse guard fibers m to "make it go farther" as I have seen some people do. Tiie result is never as pleasant. There is no comparison to a yarn spun only of the down

If the musk o. 001 is too dusty to work with comfortably, it is easy to wash before spinning. Use warm water, even hot, and a little Woolite or LOC (Amway) or some other gentle washing liquid. Soak it for a whale, then rinse, Do not be alarmed at how condensed the fiber looks when you squeeze it. It does not appear to be very much but it will go a long way when spun relatively freely Roll in a towel to remove excess moisture and then tease open to dry. If the fiber is washed before spinning, there is a definite tendency for it to twist more tightly.

Carding

If a fine yarn is to be spun, carding is not always absolutely necessary since the fibers slide easily. My first experience with spinning musk ox wool was for a person who had obtained some and carded it in order to save me time. What arrived was a fluffy mass of pills! That is exactly what happens when traditional carding methods and wool carders are used, Added to my problem was the fact that the person sat and watched whale I attempted to make good yarn out of lumps. It was indeed a memorable experience. After that I tried carding some myself, but found that the results were the same. It was not until I began working with cotton carders that carding was very beneficial at all, Cotton carders are set much more freely than any brand of wool carders and miraculously prevent the pilling. There are, however, a few pointers that are different, Where wool carding is primarily to fluff and mix the fibers, we use the cotton carders merely to align the musk ox wool and render a more uniform mass without too much mixing. It is the mixing which causes the fiber to wrap around the hooks and work into palls. The ideal would be to use wool combs, but since these are not readily available, the cotton carders do a fine job.

To begin, add an amount of musk ox wool to the left hand carder. (The amount will vary with each person and how much they feel is comfortable to work with.) Brush a few strokes, then clean off the left carder first. Replace the fibers on the left carder with the right carder using a few brushing strokes but with extremely light pressure, The fiber should not embed itself too deeply m the wires. When these first few fibers on the left carder look aligned, clean off the right carder to the left and work through these fibers a few at a time, cleaning the right carder then brushing. Repeat until the whole group of fibers looks straight, In removing the fiber from the carders you may roll or not, depending upon the effect you wish to achieve in the spinning, woolen or semi-worsted Musk ox wool will fluff even if it has been spun m a semi-worsted manner,

Carding for blending

Musk ox wool blends beautifully with fine wools, especially with high-count Merino, and with cashmere, silk, angora, camel down, etc. Because

of the characteristics of the musk ox wool, it is better to treat it alone first, carding it as if it were to be spun alone. Thus place a medium amount of it on the carders and treat as above. Then when it is all ready, place half on the right and half on the left carder, Spread the desired amount of second fiber on the left carder and begin brushing, Switch back and forth as in normal wool carding, as often as is necessary, to blend the fibers as much as desired. Pilling does not seem to be a problem once a second fiber is added, so the mixture can be carded as much as needed for the desired blend.

Spinning

After meeting up with many variations of drawing m, working with spinners from many parts of the country, and indeed from other countries (for Alaska is quite a crossroad), I have found that each method can be adapted to fine spinning given a few tricks, Fine spinning is not difficult. In fact, it is more difficult to spin an even bulky yarn than a fme one. It is mostly a matter of confidence and the knowledge of a few details. Many will think that they have no use for superfine yarns, but the excitement that I have seen each time a student achieves the "impossible" and finds how easy it is to spin a gossamer thread, is well worth the attempt

Since twist and friction between fibers are the two factors which hold a yarn together, the finer the yarn to be spun, the more twist is needed to make up for the smaller number of fibers to rub together. One must reach a happy medium, however, for too much twist can also make a fine yarn brittle. Thus it is important to know the ratio of your wheel. Determine just how much twist you will want per mch of the yarn, then keep to it. The unsure person should begin with whatever wool they have been using and get it down to as fine a yarn as possible. Then, if there is some superfine wool available, try it next. Once that feeling of confidence has come with a familiar fiber, then almost any fiber can be approached. The next important factor is to have as little tension or pull from your wheel as possible, On a bobbin and flyer wheel, ease the tension off almost completely, If using a great wheel, do not pull too hard against the quill. If using a drop spindle, use one with a fast spm and support it rather than allowing it to drop, This lack of tension will provide more complete control over the draw. For those with little confidence, I recommend the two-handed draw With hands as far apart as the fiber is long, gently draw (even down to a half-dozen or iewer fibers if you feel **brave)** then let it twist and feed on to the bobbin. Repeat, keeping the flow smooth,

In this method, the longer the draw, the finer the **yam will be. If it is too** fine then shorten up the **draw. If** not fine enough, lengthen the draw. This draw tends to align the fibers more smoothly and more tightly than the long draw does, but I have seen it give many who had used only the long draw the confidence to experiment much more than they were otherwise inclined to do. Be sure not to overtwist, but also be sure to allow sufficient twist to enter the fibers before releasing them so that the yarn does not shale apart. For superfine on the long draw, hold your hand back of the point of twist almost as far as the fiber is long. Do not hold on too tightly but let the fibers shale out as the twist runs up to take more in. Because the long draw has a tendency to put less twist in than a two-handed draw, this can be a beautiful advantage, but be sure to have enough twist so that when plied, you will not lose the strength. Do not let twist come up onto undrawn fiber—always move back fast enough to be able to draw. Keep your flow smooth and fast. If you slow down the draw too much, the yarn will thicken. If you speed up too fast, it will become too thin.

Musk ox wool has what I like to call a lot of "bounce". No matter how finely you spin the initial yarn, any tension during the drawing will cause the yarn to thicken up after it is removed from the wheel and washed. When blended, this resilience is accentuated or lessened depending on the character of the blending fiber, Cashmere, for example, has the same characteristic and so the combined musk ox wool and cashmere is a bouncy, puffy yarn. The same can be true of some wool/musk ox blends. Silk on the other hand, tends to stretch out the musk ox wool and help it to be smoother and sleeker.

Plying

When plying superfine yarns, there is a tendency to not insert enough twist and the two strands end up just lying together. This is difficult to control since most wheels take time to put a lot of twist into a superfine yarn. A flyer wheel with a high ratio and a great wheel with an accelerating head are the most efficient, but do be careful at this point.

Washing

In washing the skeins, treat as indicated under the fiber section. If you wish to use the yarn for warp, it would be useful to dry the skeins under some tension. The resilience or "bounce" is most noticeable after the yarn or piece is washed and most items must be blocked to retain the open appearance or size.

Designs in musk ox wool

The most successful pieces made from this wonderful fiber nave been those that are light and lacy The airiness of design conserves fiber, and the lace effects snow to great advantage the fluffy nature of the yarn. Even the smallest item can become a treasure. The foregoing are only tips to spinning a most delightful fiber. There is no comparison to trying it for yourself! If you should have the opportunity, approach it with confidence Do not let the fiber sit in the closet or *on* the shelf because you do not wish to spoil it. If no musk ox Wool appears, try some superfine spinning just for fun. □

MUSK OX PROJECTS

Musk Ox Top
[illegible]el Roos Haas

This project consists of musk ox fiber blended with silk, and was spun by Marilyn Biagi. The two four-ounce bags of fiber took about 50 hours to clean. All the guard hairs and heavier fiber were removed. The musk ox was then carded together with silk on cotton carders, which took about 14 hours.

The fiber was dyed in a weak indigo bath. It was dipped four times, 20 minutes each time, and oxidized for 20 minutes between each dip. It was allowed to oxidize overnight, then rinsed and immersed in a vinegar and water bath. It was again hung to dry overnight. The skeins were not weighted during drying.

The 3 yd warp (½ musk ox and ½ silk) had .240 ends, and was set at 10 epi The weave is space-dented doup leno, threaded 4,33,44,33,44 so that every other leno group was reversed This prevents the fabric from twisting out of shape The weft, about 563 yd, is ⅔ musk ox and ⅓ silk, weighed 2¾ oz After weaving in on a 25" table loom, I had about 200 yd of yarn left over, which I used to hand stitch the seams and overcast all non-selvedge edges

Cocoon Shawl with Leno
Dannetta Wakefield

This project has been a true test of patience and endurance, and the finest spinning that I have ever done in my seven years of spinning. What an enjoyable experience to spin such soft and delightful yarn and weave a garment that is wonderful to wear next to the skin, soft as a cloud.

I removed all excess fibers and spun only the underwool, the softest of all, which gave a fine, soft, unfuzzy yarn. I started with 8 oz. and my end product was 4 oz., 3000 yards, single ply, which took 100 hours to spin and ply for warp and weft.

Scarf with Leno
Carol Pattison Haas

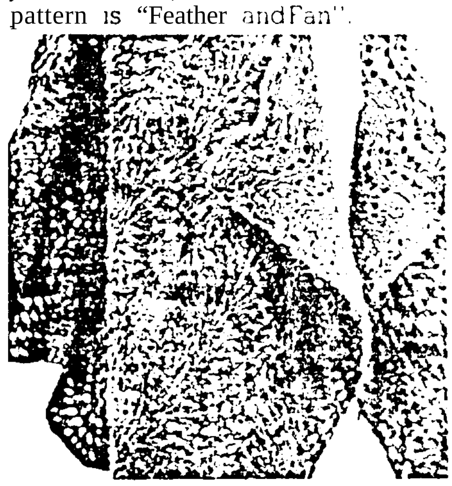
My project began with 4 oz of musk ox fiber which spun into 2 oz after cleaning all guard hairs and intermediate straight but softer fibers The scarf was woven from 560 yards, 2½ yd warp, 10 inches wide, 10 epi. The weave was tabby and hand controlled leno.

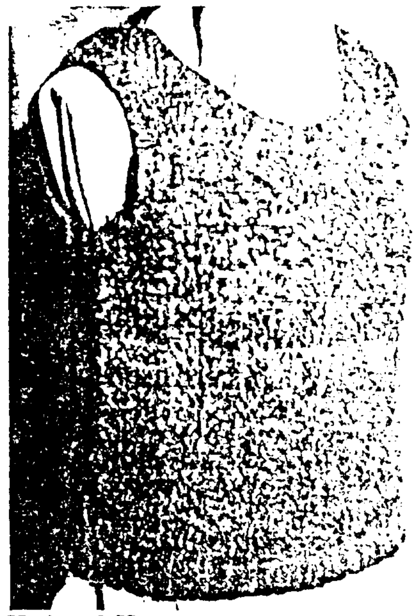
Knitted Shawl
Wendy Eisner

I had 16 oz. of musk ox to turn into 2 ply yarn. 8 oz. of my own and 8 oz. for Turid Senungetuk I kept track of the time it took to clean and tease the raw wool, spin, ply and skein the yarn. In all, 70 hours. the yield was 1200 yards of 2-ply yarn weighing 13½ oz

I found musk ox to be a less elastic fiber than wool. This affected the amount of spin necessary to make an even, attractive ply in the finished yarn. It seemed that the musk ox needed a somewhat tighter spin than wool usually does and that it should be plied soon after spinning Perhaps the fiber, being less elastic, sets itself after a while so it doesn't twist back when plied.

Although the yarn is slippery, it was easy to knit on a lightweight round plastic needle, about size 7 The shawl pattern is "Feather and Fan".





Knitted Vest
Gail Davidson March

I have been spinning off and [illegible] since 1976. I spun the yarn for my [illegible] on a great wheel, which I acquired [illegible] 1978

Spinning on the great [illegible] aesthetic experience [illegible] nicer than a treadle [illegible] ideally suited for spinning [illegible] a thin yarn spins up fairly [illegible] underwool was spun as it came [illegible] the bag and the design [illegible] colors just came about [illegible] knitted. The vest [illegible] was knitted on [illegible] 7 [illegible]

Summary of Wool Bureau Report on Musk Ox Fiber

by Fran Reed

In 1974 Carl Freeman and Francis Mayer of The Wool Bureau Testing Service, Long Island, invited me to work in their laboratories for a few days to test the qiviut fiber and the processes used to make it into a finished product. The tests involved establishing the natural oil content and the type of spinning oil used as well as the scouring, spinning, milling, bleaching and dyeing processes. Tests for durability, fade and tensile strength were also conducted.

On the unscoured raw stock, the oil, or grease content was found to 'be 6.8°/0. On raw wool, it sometimes amounts to 20%; the freer wools contain the highest proportion of natural impurities. After hand scouring the qiviut raw stock, the oil content was measured at 2.4%. Two pieces of fabric (one woven, one knmed) were dry cleaned to remove spinning oils. On the milled knitted sample, there was a 10% loss m weight, and on the unscoured woven sample, there was a 14% loss. The dry cleaning process had no adverse effect on the items, and it was assumed the 14°/0 difference on the unscoured piece indicated the amount of oil added during the spinning process.

It was recommended that a good quality vegetable oil (olive, coconut, sesame, corn, etc.) be used for the spinning. About 15% of the total weight of the prepared qiviut, i.e., dehaired, scoured, combed, etc., should be the amount of oil necessary for spinning. The more qiviut spun at one time, the easier and the less amount of oil necessary to hold the fibers together during this process.

Approximately one pound of raw stock was hand scoured The process revolved soaking the stock in warm (125°) water at a 50 1 ratio for two to four hours to remove the common dirt. Then 1% soda ash or 1% Lyogen Vu was added and the stock soaked for another hour with occasional stirring. The fiber was then removed and rinsed in warm to cool water and then dried m a drying oven. Sixty-five grams were lost m the process. The purpose of the soda ash (washing soda) is to 'crack' the oil molecules into soap; the Lyogen Vu is like a commercial detergent-it rinses the water, allowing for faster penetration,

Milling is basically the same as scouring, with an attempt to rough up the surface of the woven fabric to give a better hand to the finished product A front-loading washing machine with a back and forth action was used for this process, It is recommended over the top-loader machine action, as it allows the chemicals, not the machine parts, to do the milling. A small amount (¼ cup) of diluted Sodium (tatra) Ethyenediamine Tetraacetate (or detergent) was added to warm (125°) water. The machine was operated for 15 minutes; the garments were removed and rinsed from warm to cool water, spun dry and completely dried m a drying oven. The results were excellent, giving a healthy, soft hand and look.

Several yarn samples were bleached lightly m an attempt to reach the same color change as would occur naturally with time A reduction process using i% formic acid, 1% Lyogen Vu and 4% Zinc Sulfonylate Formaldehyde created the proper shade. These samples were then dyed with no ill effects. As with all wools, the sun's effect can alter the hand and color, Two pieces of half-dyed, halt-undyed milled samples were exposed to direct sunlight for one month. The results showed a marked difference in color and texture, especially on the exposed dyed portion. Not only did both the dyed and undyed areas change, but the 'fullness' of the milled yarn was 'burned' away, leaving the exposed area harsh to the hand. Much of the deterioration was due to the spinning oils, alone and in combination with the dye chemicals. This was quite an extreme test and most garments would not be exposed to such harsh treatment.

A small amount of raw stock was prepared, bleached white and blended into a 60% superwash wool and *40°/0* qiviut mixture. *The* results of the dyeing process were several nice pastels; however, the quality of the yarn was less than that of any fine wool, and it totally disguised the distinguishing qualities inherent in qiviut.

Qiviut is very receptive to most wool dyes. Because of its natural grayish-brown color, lighter shades of dyes are more appropriate. It is recommended that small samples of white wool and qiviut be added to each dyebath for record-keeping purposes. All samples were prescored before dyeing and all dyebaths contained Intratex A (formerly Albegal A), a non-foaming, wool leveling agent for acid at 1:1. Dyebaths used pre-metalized, chrome, selective reactive, and mixtures of these dyes at 1.2, At the Wool Bureau the following procedure was used.

Set cold (80- 110") distilled water
Add chemicals and dye goods
Run for 10 minutes
Add dissolved dyes
Run for five minutes, raise to boil at 2°/minute
Run for 15-60 minutes depending on color/shade
Remove from heat and rest for 30 minutes
Rinse in warm 10 cool water

An examination of the tensile strength of the fiber resulted m the discovery of a very strong fiber. A woven sample of 4 ply/6¼ run qiviut was tested at 70 (psi) as compared to the average men's wear fabric of 40 or women's wear rating of 20.

In addition to these findings from The Wool Bureau, it has been stated that qiviut is approximately eight times warmer than wool. Because of its lack of crimp or large scales, qiviut has almost no elasticity, but it also will not shrink *or* felt. The yarn is *very* sleek and has a slight tendency to slip m the warp during the weaving process These characteristics should be kept m mmd when deciding the type of garment to make with this fiber.

Qiviut is very similar to cashmere, and its preparation should follow m the same manner, As with cashmere, there is a large amount of waste m separating the guardhairs from the spinnable underwool. One can expect to lose at least 200/0 due to the unspinnable fibers. This is an extremely light fiber and a few grams can go a long way The traditional qiviut scarf produced by the knitters of the Musk Ox Producers' Cooperative weighs a mere 40 grams. □

Fran Reed was the qiviut dyer/finisher for the Musk Ox Producers' Cooperative from)971-1975. She is presently the weaving instructor for (he Tanana Valley Community College, Fairbanks, Alaska.

References

Qiviut Fiber and Garment Report, Frances Reed. April, 1974 **Fairbanks**
Handbook of Textile Fibers, J **Gordon Cook**, Merrow Publ Co England **1968**
The Testing of Yarns & Fibers, Harry Curtis, Pitman & Sons. London 1962
Melliand Textile Monthly. Vol **III**, "Musk-ox Wool & Its Possibilities As A New Textile Fiber Werner Von Bergen, 1932