Investigation of Faeces from a Mummified Eskimo Woman

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The microscopic analysis of faeces was carried out by a method described in the following. As is usual in the analysis of faeces or stomach contents, the identification of fragments was verified by means of standard comparison material.

Several fragments from cormophytes were identified, *Empetrum sp., Alopecurus sp., Elymus sp., Conifera sp.* and a number of moss species. Furthermore, spores, pollen, fungi, and eggs from a parasite were found. Hairs and feathers of arctic animals were observed.

The examination of the visceral contents has to some extent elucidated the diet of the inhabitants of Greenland 500 years ago, but it did not answer the question at what time of the year this Eskimo woman died.

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Mummy No. 7, determined to be a young woman aged 18–22 years, was in such a good state of preservation that a proper examination was possible after rehydration of the inner organs. The stomach was empty, but in the lower part of the large intestine, some lumps of faeces were found. Half of these were sent to the Department of Pharmacognosy in May 1983 for examination, and the investigation was carried out during the autumn of 1983.

The sample was prepared for microscopy in the conventional way for non-mummified faeces. The sample is stirred up with 96 % v/v ethanol and remains in ethanol for at least 24 hours. The ethanol is removed by means of a suction funnel, and the remanence washed out with ethanol. The ethanol is kept in a bottle for forencis investigation, if necessary. The remanence is degreased with ether. The ether is discarded. The remanence is then divided into two parts. One part, kept in 70 % v/v ethanol, is used directly for microscopic purposes with the following clearing reagents:

1. Water (to find starch)
2. Solution of chloral hydrate 5 + 2 (cold)
3. Solution of chloral hydrate 5 + 2 (boiling)

One drop of glycerol is added to specimens mounted like 2 and 3 to prevent crystallization.

The other part of the remanence is boiled for about fifteen minutes with hydrochloric acid 2 N to eliminate starch. The sediment is kept in 70 % v/v ethanol. If necessary, the sediment can be bleached with sodium hypochlorite before microscopy.

To prepare for microscopy, many small samples were taken from the prepared samples.

In faeces quite a number of uncharacteristic brown particles without cell structure are normally found. These cannot normally be identified; neither could they in this case. One cannot expect to find much animal tissues, as most of this has already been digested before the visceral contents reach the lower part of the large intestine. Only remains of plant tissue with thick walled cells and tissue with particularly resistent cell walls, e.g. hair with silicic acid in the wall, may be found. Therefore, it was very surprising to find a relatively high proportion of plant fragments with many different types of cell tissues.

We had not imagined the possibity of finding well-preserved tissue structure in this 500-year-old faeces lump. A comparatively large quantity of grains of sand in the preparations tells us that the food was polluted by soil. Soil and peat may have come from the peat walls around the cooking area.

For verification, we found it necessary to use standard comparison material for microscopic analysis. In this case, we found it exceptionally important, as we realized that the Eskimo might have consumed food unknown to us. Using such comparison material, received from University departments in Denmark, or belonging to the Department of Pharmacognosy, we could establish that the following was present in the sample:

Fig. 1. *Empetrum nigrum* ssp. *hermaphroditum*. Particle from the faeces showing covering hairs and one glandular hair. Mag. × 250.

Empetrum nigrum L. ssp. *hermaphroditum* (Hagerup) Böch, *Empetraceae,* (Crowberry)

Various fragments of leaves, still exhibiting covering hairs and glandular hairs, were identified as belonging to angiosperms (Fig. 1). These were determined to originate from *Empetrum nigrum,* ssp. *hermaphroditum* (Crowberry). However, we found neither fragments of fruits, nor particles of the stones, although these are so resistant that they normally pass unchanged through the intestinal tract.

Crowberry grows on heaths and in bogs, and is nowadays widespread in the southern part of Greenland. Crowberry is less common in north-west Greenland (Böcher *et al.* 1978).

Cassiope tetragona (L.) D. Don, *Ericaceae,* (White arctic Bell-heather)

Various particles of leaves identified as leaves from White Arctic Bell-heather were found. *Cassiope tetragona* forms heaths in the northern part of Greenland and is nowadays widespread around Qilakitsoq (Böcher *et al.* 1978).

Alopecurus alpinus Sm., *Poaceae,* (Mountain Foxtail)

Fragments of axes of stems with characteristic epidermis and covering trichomes were found. Mountain Foxtail grows in bogs, along riversides, near bird cliffs and around former habitations in north-west Greenland. (Böcher *et al.* 1978: Gassner 1973).

Elymus mollis Trin., *Poaceae* (Downy Lyme-grass)

Fragments of stems with trichomes very similar to the standard comparison material were found. Downy Lyme-grass grows on open, sandy ground on coasts and in river valleys. This species occurs in the southern part of north-west Greenland (Böcher *et al.* 1978).

Conifera sp., (Conifer)

Both conifer pollen and small fragments of conifer wood with the characteristic bordered pits were found. As no *Conifera* species grows in Greenland, it may be suggested that the fragments derive from wind-borne eroded conifer wood or from driftwood collected at the settlement by the inhabitants and used both for making tools and as firewood. A few of these fragments showed traces of carbonisation and may probably derive from burnt driftwood (Fig. 2).

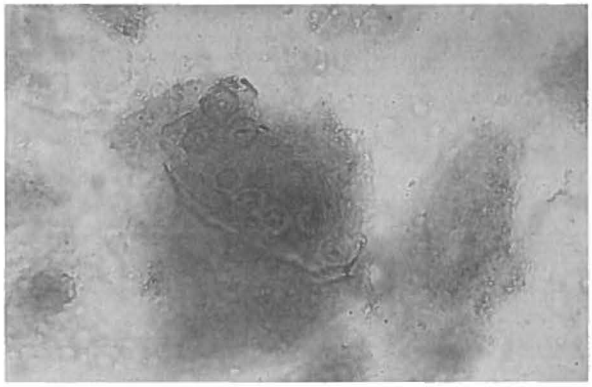

Fig. 2. *Conifer* sp. Particle from the faeces showing fragments with bordered pits.
Mag. × 250.

Several fragments from higher plants were found. The particles consisted of fragments of vascular bundles, but the surrounding tissue was so decomposed that they could not be finally identified. The group of lower plants was plentifully represented, especially by many whole shoots, leaves and leaf fragments from various mosses and bog mosses.

The following mosses have been identified (Andersen *et al.* 1976; Jensen 1923):

Aulacomnium turgidum (Wahlenberg) Schwaegr., *Aulacomniaceae*

Both shoots and fragments of leaves from this moss were found. The plant is common all over Greenland in almost all moist plant communities, like *Betula nana* heath, *Salix-Eriophorum* fen, *Vaccinium* heath, *Carex* fen and bogs, marshes, snowpatches and on soil between cliffs. (Fig. 3).

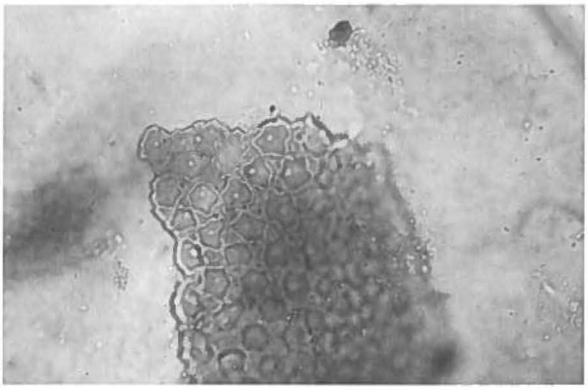

Fig. 3. *Aulacomnium turgidum*. Particle from the faeces. Mag. × 400.

Drepanocladus uncinatus (Hedw.) Warnst., *Amblystegiaceae*

Shoots and fragments of leaves were found. The plant is common all over Greenland, but rare in the far north. It is common in both moist and arid plant communities.

Hypnum sp., *Hypnaceae*

Only small leaves of *Hypnum*, represented by several species in Greenland, were identified.

Dicranum sp., *Dicranaceae*

Fragments of leaves were identified as belonging to this genus. Fragments probably belonging to the genus *Onchophorus* were also found.

Fragments of leaves from other mosses and *Sphagnum* (bog mosses) were found but have not been identified.

Furthermore, spores from *Lycopodium* sp., *Lycopodiaceae* (Club moss), pollen from *Conifer* and other plants, and many hyphae from unidentified fungi were found.

In the faeces sample, a few small particles of striated musculature were also found. They may come from meat or from fish, but cannot be further identified. However, particles from the following animals have been identified (Appleyard 1960; Grassé 1965):

Phoca groenlandica., Phocidae (Harp seal), or other species

Many hairs of different length and width were identified.

Rangifer tarandus, Cervidae (Caribou)

Only short pieces of broken-off hairs were found.

Lepus timidus, Leporidae (Alpine hare)

Some long hairs were found.

Lagopus mutus, Tetraonidae (Ptarmigan) and *Plotus alle, Alcidae,* (Little auk)

Feather and down, which – in the microscope – were quite similar to the standard comparison material, were found.

Acarina, (Mites)

Sugar mites (*Glyciphagus domesticus*) or Orbatid (*Tyroglyphidae*) and moss mite (*Oribatidae*) were identified. More mites – impossible to identify because of their poor condition – were also found (Fig. 4).

Fig. 4. *Oribatidae.* Moss mite from the faeces.
Mag. × 250.

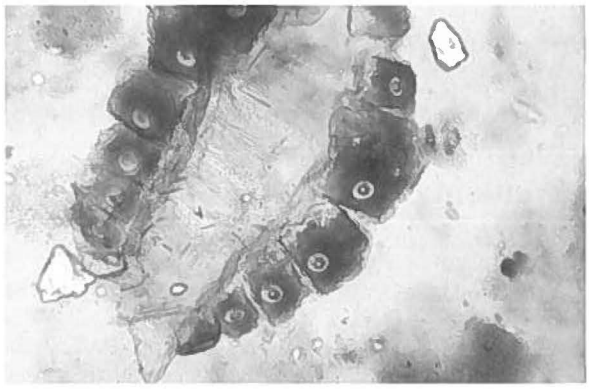

Fig. 5. *Pediculus humanus subsp. capitis.* Part of head louse from the faeces.
Mag. × 100.

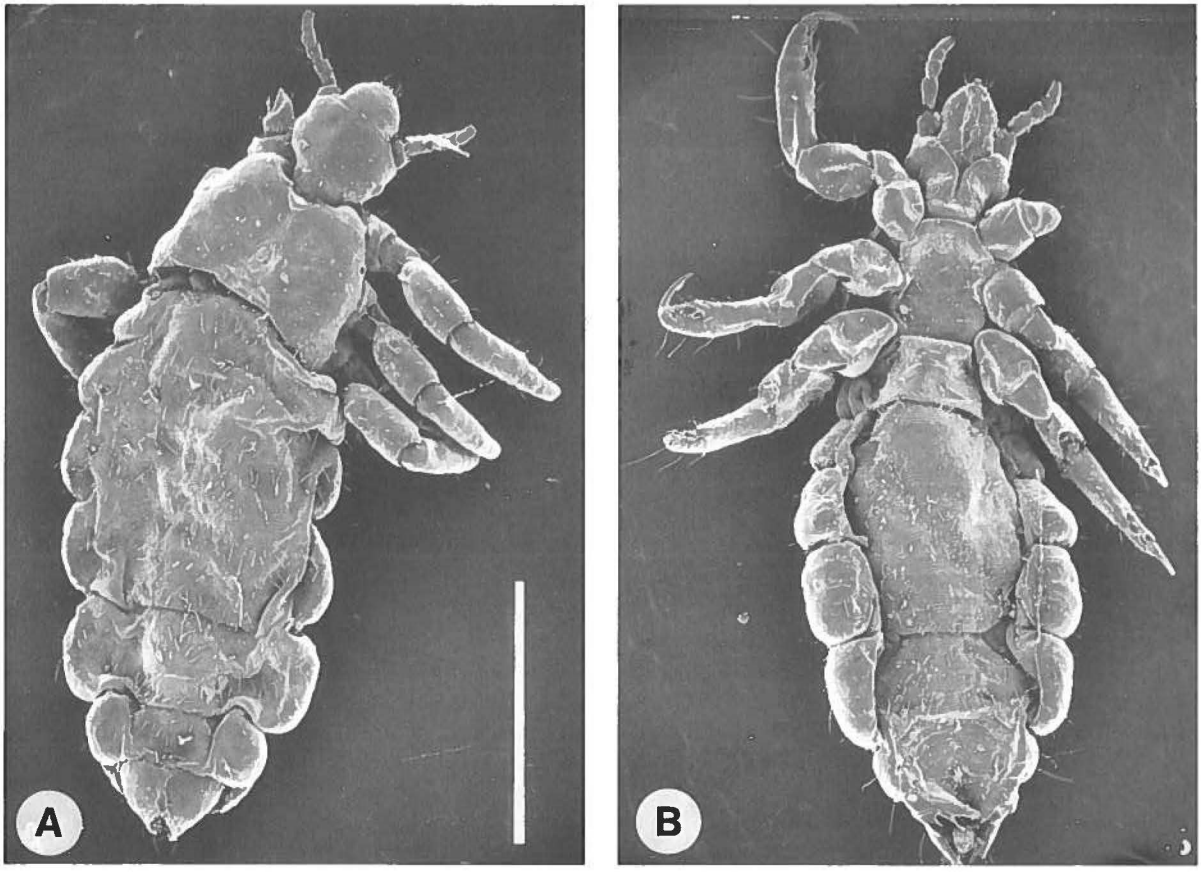

Fig. 6A and B. *Pediculus humanus subsp. capitis* deGeer from a mummified corpse of an Eskimo.
A: dorsal side (♀)
B: ventral side (♀)
Bar A & B 1 mm.

Pediculus humanus capitis. (Louse)

We found both big and smaller parts of lice but none was quite intact. Lice were also found on the hair of five of the Eskimos and in the pants of one of the women (Bresciani *et al.* 1983) (Figs. 5–6).

Enterobius vermicularis, Oxyuridae (Pinworm)

Several almost elliptical bodies measuring 50–75 µm were found. These bodies are probably ova from pinworms (Chandler & Read 1961).

Because of the many fragments of leaves from Crowberry, Mountain Foxtail and various mosses, it is assumed that these plants were part of the food. Furthermore, we suppose that the small particles of striated muscle from animal tissue were also part of the food.

When eating animals, the Eskimos may have eaten the animals' stomach contents as well. However, the identified fragments from plant tissue are in such a good state of preservation that we doubt that they have been exposed twice to the pancreatic juice, first in an animal and then in the gastrointestinal canal of a human being. On the contrary, we suppose that pollen, spores, fungi, mites and fragments from Conifer are impurities.

Hair, feather and down may be present in the intestinal canal because of unhygienic behaviour, or perhaps the Eskimos of those days also stored their food in their distinctive way, preserving whole birds and various plants or parts of plants together in the same bag made of sealskin.

It is not possible – on the basis of this microscopic analysis – to determine whether the Eskimo's last meal was consumed in summer or winter. The relatively high proportion of plant particles could mean that the last meal was enjoyed in the short summertime, when Crowberry, White Artic Bell-heather, Mountain Foxtail and Downy Lyme-grass flourished. Perhaps the Eskimos stored their food until the wintertime, as mentioned above.

Only leaves from *Empetrum nigrum* ssp. *hermaphroditum* were found, no berries or seeds (stones). The stones are very resistant and would undoubtedly have been present in the faeces if eaten. Today, the Eskimos consider Crowberries a delicacy. Therefore, we presume that the Crowberries were not ripe at the time of the woman's death.

Acknowledgements

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