NGU Rapport nr. 95.111

Ecogeochemistry Kola - Field Manual

NORGES GEOLOGISKE UNDERSØKELSE

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf. 73 90 40 11
Telefax 73 92 16 20

RAPPORT

Report no. 95.111	ISSN 0800-3416	Gradering: Åpen

Title
Ecogeochemistry Kola - Field Manual

Author:
Matti Äyräs and
Clemens Reimann

Client
Ministry of the Environment/NGU

Country:

Commune:

Map-sheet name (M=1:250.000)

Map-sheet no. and name (M=1:50.000)

Deposit name and grid-reference:

Number of pages 33 Price: kr 60,-

Map enclosures:

Fieldwork carried out:	Date of report:	Project no.:	Person responsible:
	29.06.1995	63.2590.02	Tor Erik Finne

Summary:
During the period 1994-1996, the Geological Survey og Norway (NGU) and Finland (GTK) and the Central Kola Expedition (CKE) are carrying out a joint project on eco-geochemical mapping and monitoring within an area extending from longitudes 24° to 35°30' and southwards to the Arctic Circele in Finland and to the boundary between the Murmansk and Karelia regions in Russia.

As a part of this project, a detailed study of eights catchment areas (three in Finland, one in Norway and four in Russia) was carried out during 1994. The following sample media were taken for this catchment study: snowpack, topsoil, stream water, organic stream sediment, rainwater, moss, podzol profiles, groundwater, rocks and Quaternary deposits.

In 1995, regional sampling will be carried out at a density of 1 sampling station per 300 km^2 throughout the project area. Sample media for this regional study are: humus(o-3cm) podzol profiles (5 layers) terrestrial moss and topsoil (0-5cm, for radionuclide anlysis). In the Russian poject area, lake water samples will also be taken.

This manual contains all information and instructions given to the field sampling teams. The first part describes the methods used for the catchment study, the second part gives the instructions for the regional sampling in 1995 and the third part gives a short description of the equipment that was specially developed for this project.

Keywords:	Geochemistry	Podzol
Snow	Moss	Streamwater
Topsoil	Humus	Manual

TABLE OF CONTENTS

Appendix I:

Field form used for collecting field information for the catchment studies 1994.

Appendix II:

Field form used for collecting field information for the regional mapping project 1995.

Appendix III:

Additional field form used for podzol profile descriptions in Norway and Russia.

Figures:

FIELD MANUAL FOR THE CATCHMENT STUDIES 1994

This part of the field manual for the "Eco-geochemistry Kola" project was prepared for the field work in the catchment study following a project meeting in Ivalo 26th-28th January 1994.

A variety of different sample media were taken from both the terrestrial and the aquatic environment and at varying time intervals: snow cover; topsoil (0-3cm) in winter, spring and summer; stream water once a month (5 catchments) to once a week (3 catchments); organic stream sediments three times during the summer; feather moss twice during the summer; rainwater monthly and podzol-profiles once in July/August. In addition, rock samples and Quaternary deposits were collected according to the standard procedures of the geological surveys. Special instructions for collecting stream water, moss and humus samples for sulphur isotope analyses are also included in this manual.

The purpose of this manual is to document the sampling procedures for all organizations and persons working in the field on the "Eco-geochemistry Kola" project.

The first part of the manual includes the following instructions (author(s) in parentheses):

Snow cover sampling (Matti Äyräs and Viktor Chekushin)
Sampling of surface waters in winter and summer (Clemens Reimann and Øystein Jæger)
Terrestrial moss sampling (Matti Äyräs)
Topsoil sampling in winter and summer (Matti Äyräs)
Stream sediment sampling (Matti Äyräs)
Sampling of rain water (Clemens Reimann and Tore Volden)
The field card for the identification of samples and for collecting the mandatory field information (Clemens Reimann)
Soil profile sampling (Marjaliisa Räisänen and Galina Kashulina)
Moss and humus sampling for Sulphur Isotopes (Patrice de Caritat)
Stream water sampling for Sulphur Isotopes (Patrice de Caritat)

The snow cover was collected at a density of approximately 12 sampling sites per catchment in late March/early April 1994.

Stream water sampling at the outlet of each drainage area commenced at the same time as the snow cover sampling and continued at monthly intervals. In one catchment per country, stream water sampling was carried out weekly.

Terrestrial mosses were collected twice - in June and August at 7 sites per catchment.

Topsoil sampling started at the same time as snow cover sampling and continued into May or early June immediately after snow melting (15 - 25 sites per catchment). Additional samples were taken in July and September (10 to 15 sites).

Stream sediment sampling started in May and was repeated in July and September (from 3 to 5 sites depending on the type of drainage system).

The rain water collectors - three groups of five collectors per catchment - were installed in May and composite samples were taken monthly. In one catchment per country and once in the period, the samples were taken separately from each collector tube.

Podsol-profile sampling was carried out in all catchments by one team during the period 20th July - 14th August. There were up to three podsol profile sampling sites per catchment.

All samples for sulphur isotope analysis were taken at the same time as the podsol profiles.

SNOW COVER

Matti Äyräs and Viktor Chekushin

Selection of sampling site: Preferably a level area, 20 x 20 m, with uniform snow depth. The sampling area must be as undisturbed as possible. No sampling should be undertaken in places where the snow has been transported by wind or partly melted and also no sampling underneath trees. The snow cover at each sampling site must represent the average snow cover of the sampling area.

Sampling: The snow cover must remain undisturbed, no walking, skiing, etc, before sampling. A clear plastic tube with a closing mechanism (Finnish type, inside diameter 92.5 mm) must be used for sampling.

The snow sample should be taken throughout the whole snow column vertically from the top of snow-pack to the ground. Every effort must be made to avoid mixing with local vegetation and soil, i.e. the lowest 5 cm of the snow cover should be excluded. The samples are collected into a large clear polyethylene bag. When removing the snow sample from the sampling tube to the bag, all needles and other litter in or on the column should be removed using disposable plastic gloves. The samples must be kept frozen until arrival at the laboratory.

The closing mechanism should retain the snowpack in the tube when lifting the tube. If this does not happen, a pit must be dug in the snow cover and the tube must be closed with a plastic stopper at its lowermost end.

A composite sample should be taken so that the total weight of snow sampled is 4-6 kg. The number of subsamples depends on the thickness of the snow cover but no fewer than 3 should be taken. The distance between subsamples collected must be about 10 m, forming an equilateral triangle in the case of three subsamples.

CAUTION: Every effort should be taken to avoid contamination. The sampling equipment must be stored clean in its container and the sampling bags must be kept clean until the sample is taken. The sampling tube must be cleaned by washing with snow at the sampling site. Smoking is not allowed during sampling.

The field information given on the field information sheet must be recorded.

SURFACE WATER

Clemens Reimann and Øystein Jæger

The stream water samples should be taken at the outlet of each catchment area.

Equipment:
- 1 x 100 ml PE-bottle
- 1 x 500 ml PE-bottle
- PE-syringe
- Millipore filter MILLEX-HA 0.45 µ
- HNO_3 ultrapure
- pipette
- exchangeable tips for pipette

Sampling: At each locality, two samples should be taken. These samples should be taken 5-10 cm below the water surface.

Sample 1 (cations):
- mark the bottle with the sample number (using a black marker!) according to the field notes
- wash the PE-syringe thoroughly 3 times in stream water
- suck in stream water from 5-10 cm below water surface!)
- mount Millipore filter on syringe
- filter some water into the 100 ml PE-bottle. Screw the cap on and shake the bottle to rinse it. Empty the bottle.
- filter ca. 100 ml of stream water into the bottle - the bottle should be filled to the top
- squeeze the bottle gently when screwing the cap onto it to avoid trapping any air in the bottle

Sample 2 (pH, electrical conductivity, alkalinity and anions):
- mark the bottle with sample number (using a black marker)
- wash 500 ml PE-bottle thoroughly in stream water
- fill the bottle to the top with water taken 5-10 cm under the surface
- squeeze the bottle gently when closing it to avoid trapping any air in the bottle

Conservation: Done in the car or at the end of the day.
- All samples in the small 100 ml bottles must be acidified.
- Screw off the top of the first bottle (one at a time only)
- decant some water from the sample to make room for the acid
- put a new tip onto the micro-pipette supplied and check that the reading is set to "500" (0.5 ml)
- suck up ultrapure HNO_3 from the acid bottle supplied. Be careful as the acid is very strong - read the safety guidelines on the bottle. Make sure not to touch the acid with anything other than a new pipette tip every time. Store the acid in a safe place and always keep it closed. Do not use this acid for any purpose other than acidifying the water samples
- add the acid to the sample without spilling any. If there are problems with any samples with this procedure please mark it on the field notes
- mark the cap of each bottle containing acidified stream water with a cross and close the bottle. Squeeze any air out of the bottle while closing it.

Storage and transport: - store and transport all samples dark and cool (0-4 degrees Celsius) if possible. All samples should be shipped to the laboratory as fast as possible. If any samples could not be stored cold for more than a day please note it on the field notes.

Surface water sampling in winter

Additional equipment:
- a second 500 ml PE-bottle
- spade
- ice-drill (as used for ice-fishing)

Sampling:
- take the samples wherever possible along ice-free, open stretches of the streams. Take a spade to remove any snow cover. After removal of any snow cover, wait ten minutes before sampling to avoid sampling of snow melt water.
- if there is no open stretch along the stream to be sampled you will have to drill a hole in the ice. After drilling, clean the hole so that no snow or ice is on the water surface and wait 10 minutes before sampling.
- if necessary, use the additional 500 ml PE-bottle to take sample 1 (unfiltered) and carry out the filtering procedure in the field camp (to avoid freezing of the filter). First use some of the water to clean the syringe and then some of the filtered water to clean the 100 ml bottle.
- sample 2 is taken as above.

ATTENTION: Always be aware that we are analyzing the water samples at the low ppb-level. These samples are extremely susceptible to contamination. Use utmost care to avoid contamination. Do not touch any surface that comes into contact with water with your fingers (filter, pipette tips, insides of bottles, bottle caps, syringe).

TERRESTRIAL MOSS

Matti Äyräs

Selection of sampling site: The size of a suitable moss sampling area is about 50 x 50 m. The samples should be collected from clean moss cover. The area must be as open as possible outside the tree canopy. Subsamples should be collected at least 5 m from trees and 2 m from bushes.

Sampling: Only one species of feather moss, either *Hylocomium splendens or Pleurozium schreberi*, should be collected as a clean sample. Only the three most recent green annual shoots should be taken. These are easily recognizable for *Hyloconium splendens.* For *Pleurozium* schreberi there is a slight "bend" in the plant after each year. Take care to only sample the last three years. Use disposable gloves. Every effort should be made to avoid mixing the sample with minerogenic matter and other litter. A composite sample (minimum five subsamples) should be collected. The samples must be taken in an open area i.e. not underneath trees, bushes or dense vegetation.

The volume of each sample must be between 0.5 - 1 l. The samples should be collected in paper bags by hand and stored at room temperature.

CAUTION: The use of disposable gloves is mandatory. Smoking is not allowed during sampling.

The field information given on the field information sheet must be recorded.

TOPSOIL

Matti Äyräs

Selection of sampling site: The sampling site should represent the predominant type of superficial material and vegetation of the catchment. Steep slopes, active river and stream channels, and lake and sea beaches should be avoided. In a catchment area dominated by hills, topsoil samples should be sampled from the flat area on the hill tops. If a valley topography is predominant, topsoil is sampled from the flat part of the valley bottom or from gently sloping areas.

Sampling: The sampling equipment consists of a well sharpened trowel (from which all paint should be removed) and a sharp stainless steel knife.

Each topsoil sample should be a composite sample of four subsamples. On each occasion (winter, May, July and September), the subsamples should be taken from exactly the same location using the same method. The subsamples are taken from the corners of a 20 x 20 meter square. At each corner, a topsoil cake of 20 x 20 cm and min. 3 cm thick is removed with the trowel. The green parts of vegetation and undecomposed needles and leaves should be removed from each cake using the knife. The thickness of each sample should be approximately 3 cm. At this depth, the sample is cut with the steel knife. The presence and amount of mineral soil should be recorded on the field form. Bigger roots, etc. should be removed if possible.

In spring the best time to take the humus samples is just after the flood when the humus is no longer saturated with water. The depth of frost penetration should be measured.

The samples should be stored in plastic bags. A sample of at least 1.5 kg must be taken. In winter, the sample must be kept frozen until arrival at the laboratory.

Field information is collected according to the field information sheet.

STREAM SEDIMENT

Matti Äyräs

Selection of the sampling points: Each stream sediment sample should be taken at 3 - 5 sites over a distance of 100 m in the catchment area. One sample should be taken at the outlet of the main river, and the others along the upper course of the river system, preferably along the tributaries.

Sampling: The sampling equipment must be cleaned in stream water at the sampling point before sampling. Disposable gloves must be used for sampling (one pair per catchment).

The sample should be collected from the fine-grained, organic-rich, well-decayed suspended material situated below the stream water level. This kind of material exists mostly in the sidewalls of a river where the water flow is slowest (such as in the coves or bends of a river where the water is deeper and quieter). A sieve cloth net ("butterfly net") should be used for sampling. The suspended material can be removed from the bottom of the river by stirring the water and the resulting suspension can then be collected in the butterfly net. The collected suspended material should be mixed with stream water in a plastic bucket, from which it can be sieved through the butterfly net so that the sand and other coarse material remains at the bottom of the bucket. The collected suspended material should then be pressed as dry as possible. The volume of the final sample must be at least 0.5 l and should be stored in a large paper bag.

The field information asked for on the field information sheet should be collected.

RAIN WATER

Clemens Reimann

Equipment:
- 1 x 100 ml PE-bottle
- 1 x 500 ml PE-bottle
- 1 x 2l PE-measurement cylinder
- 1 x 10l PE-bucket with lid
- PE-bags
- PE-syringe
- Millipore filter MILLEX-HA 0.45 µ
- HNO_3 ultrapure
- pipette
- exchangeable tips for pipette

Sampling: Start with putting one of the white PE-plastic bags into a bucket and close the lid of the bucket. Do not touch the inside of the plastic bag with your hands!

Check each of the five station for contamination. Use only the samples from those stations without contamination (i.e. those without leaves, needles, dirt, etc.) for producing the composite sample. Check by eye the sample volume at each station. Exclude stations with atypical water volumes. If all samples are contaminated, use the three least contaminated stations but note down that there was contamination and record the type (e.g. leaves, needles, etc.). Pour the contents of each sampler through the hole in the lid into the bucket.

At each station, two subsamples are taken from the bucket:

Sample 1 (pH, electrical conductivity, alkalinity and anions):

- mark the bottle with the sample number (use a black marker only!)
- pour some rain water into the 500 ml PE- bottle and wash it throughly (do not immerse the bottle in the bucket!)
- fill the bottle with rain water to the very top (pour - do not put the bottle or fingers into the bucket containing the sample)
- squeeze the bottle gently when closing it to avoid trapping any air in the bottle

Sample 2 (cations):-mark the bottle with the sample number

- wash the PE-syringe throughly 3 times in rain water
- suck in rain water (5-10 cm below surface!) (watch your fingers!)
- mount the Millipore filter on to the syringe
- filter some water into the 100 ml PR-bottle. Screw the cap on and wash the bottle with the filtered water
- filter ca. 100 ml of rain water into the bottle - the bottle should be filled to the top. If more than one filter has to be used - note it down!
- squeeze the bottle gently when screwing the cap on to avoid trapping any air

Put a new plastic bag into each of the samplers and discard the old bags. Always use the same station number (1-5) for each station. Remount the samplers.

Pour the water from the bucket into a measuring cylinder and record the volume. Do not forget to record the number of stations used for producing the composite sample! Do not add the 600 ml taken off for the samples to the sample volume recorded.

Take the plastic bag from the bucket and discard it.

Conserving: Done in the car or at the end of the day.

- all samples in the small 100 ml bottles need to be acidified. Screw off the top from the first bottle (one at a time only)
- decant some water from the sample to make room for the acid
- put a new tip onto the micropipette supplied and check that the reading is set to "500" (0.5 ml)
- suck up ultrapure HNO_3 from the acid bottle supplied. Be careful as the acid is very strong (read the safety quidelines on the bottle!) Make sure not to touch the acid with anything other than a new pipette tip each time. Store the acid in a safe place and always keep it closed. Do not use this acid for any purpose other than acidifying the water samples.
- put the acid into the sample without spilling any.
- mark the cap of each bottle with acidified rain water with a cross and close the bottle. - Squeeze any air out of the bottle while closing it.

Storage and transport: - store and transport all samples dark and cool (0-4 degrees Celsius) if possible. All samples should be transported to the laboratory as rapidly as possible. If any samples could not be stored cold for more than a day please mark it on the field notes.

SOIL PROFILE

Marjaliisa Räisänen and Galina Kashulina

A soil layer (horizon) is differentiated from the one adjacent by characteristics that can be seen in the field - colour, texture, structure, grain size distribution and consistency. The distinction is not always clear, however, since soil-forming processes are often active throughout stratified materials.

Capital letters (H), O, A, E, B and C indicate master layers. Master layers (O,A,E,B,C) and transitional zones (AB/BA, EB/BE, BC) of a profile are identified and sampled separately according to the layer definition given below. No layer less than 1 cm thick should be sampled. The sampling depth of the pit varies from 50 cm to 150 cm depending on the thickness of the diagnostic soil layers and the depth of the bedrock surface.

H: Organic layer formed from the surface accumulation of organic material that is saturated with water for prolonged periods. This layer generally occurs in peatlands.

O: Organic layer overlying mineral soils formed from poorly-decomposed to well-decomposed humus layer, which is not saturated for more than a few days a year and contains 20 % or more organic carbon. Thick roots should be removed during the sampling.

A: Surface mineral layer mixed with humus material. The organic matter in A layers is well decomposed and is either distributed as fine particles or is present as coatings on the mineral particles. The A layer is normally darker (greyish black) than the adjacent underlying layers. The A layer does not generally occur in intensively leached podzols.

E: Mineral layer showing concentrations of sand and silt fractions high in resistant minerals (quartz), resulting from a loss of silicate clay, iron and/or aluminium (eluviation). The eluvial (E) layer is distinguished by lighter colours (grey, brownish grey, white, blueish white, etc.).

B: Mineral layer characterized by an illuvial concentration of iron, aluminium and organic matter, alone or in combination (maximum enrichment of sesquioxides, specifically that of Fe). B layers may vary significantly. Generally, B layers need to be qualified by a suffix to give sufficient information in a profile description. For example, a "humus B" layer is designated as Bh whilst an "iron B" is designated as Bs. In the field, B layers are designated as B_1, B_2, B_3,....etc. but the final designation is made on the basis of chemical analysis (Al, Fe and Si speciation). Thus, the B_1 layer represents the darkest upper part of the illuvial layer whilst the B_2 layer represents the lower part of the illuvial layer.

AB or BA: Transitional zone between the A and illuvial (B) layers (E layer absent). Layer in which the properties of the A and B layers merge. The first letter marks the master layer which the transitional layer most resembles.

EB or BE: Transitional zone between the eluvial (E) and illuvial (B) layers. Layer in which the properties of the E and B layers merge. The first letter marks the master layer which the transitional layer most resembles. (EB = eluviation > illuviation and BE = eluviation < illuviation).

BC: Transitional zone between the illuvial (B) layer and the parent material (till, glacio-fluvial or fluvial silt, sand, gravel) where the precipitation of sequioxides gradually decreases downwards. Samples of the BC layer are taken from beneath the illuvial layer at intervals (of usually 10-20 cm thickness) down to the underlying parent material. The precise sampling interval should be based on the heterogeneity of the morphological flatures, such as the mineral soil texture and grain size. Subsamples of the BC layer are designated as BC_1, BC_2, BC_3,...etc. The colour of the BC layer varies from yellowish brown to greyish (or light) yellow.

C: Parent mineral soil layer above bedrock which does not show properties diagnostic of any other overlying master layer. If the C layer is not of the same material from which the soil is presumed to have been derived, the boundary zone between the different horizons should be carefully identified and sampled. At least 2 samples should be taken from the C layer at an interval of 10-20 cm. C layers are designated as C_1, C_2,...etc.

Field observations

The field description of the site includes the following parametres:
- number of catchment;
- number of soil profile;
- date of sampling;
- coordinates;
- landscape: land form of area, land element of the immediate surrounding of the site and position of the profil within the land element.
- description of the vegetation, including the following parametres: type of ecosystems (according to the dominant types of tree and ground vegetation); a list of the main types of plants (trees, shrub, shrubby-grass and moss-lichen layer separatly); and evidence of disturbances of the ecosystem.
- soil type;
- bedrock type;
- type of parent material: genetical type and texture class,
- source and level of pollution;

The soil profile description for every horizon or sub-horizon includes the following parametres:
- horizon index;
- average depth of the lower horizon boundary;
- variation in horizon thickness;
- soil colour according to the Munsell soil colour chart;
- moisture;
- texture class for particles less than 2 mm;
- content of gravel and stones;
- compactness (with the following gradation: compact, slightly compact, loose);
- evidence and character of cementation;
- evidence and character of coatings;
- content of roots;
- character of the boundary between horizons;

In addition some sentences outlining the peculiarities of each site and profile.

References:
FAO-Unesco Soil map of the world, Revised Legend, Rome 1988.
Munsell. Munsell soil color charts, Bultimore, 1975.

MOSS AND HUMUS FOR SULPHUR ISOTOPE ANALYSIS

Patrice de Caritat

Equipment: plastic bag
disposable gloves (1 per sample)

Collect enough moss/humus to fill the plastic bag provided, avoiding contamination (use gloves to collect and handle sample).

Air-dry (or low temperature oven, <60 ^{0}C) samples thoroughly (e.g. indoors at least overnight; place sample on the bag and turn over as necessary. Use gloves!). Any residual humidity will promote anaerobic reactions, including sulphate reduction, and must be avoided.

When samples are properly dried, transfer to a new bag if necessary (field bag may still be wet), seal and send for S-isotope analysis (Univ. of Calgary, labels provided).

STREAM WATER FOR SULPHUR ISOTOPE ANALYSIS

Patrice de Caritat

Equipment: 1 x five-litre plastic bucket
1 x five-litre plastic container (jerry-can)
dilute HCl (for acidifying)
$BaCl_2.2H_2O$ powder (provided in 100 ml plastic bottle)
Nalgene Polysulfone filter holder (500 ml upper chamber/1000 ml receiver)
0.45 micron Millipore filter papers
Hand-operated Nalgene field vacuum-pump, with hose
pH-paper, disposable cloves

Select and record a suitable location for sampling stream water (high discharge preferable). Collect the stream water in a 5 l plastic bucket previously rinsed with stream water.

Connect the vacuum pump to the lower receiver. Place filter (using disposable gloves and removing the 2 blue protective papers) on the clear/smoky filter support and screw on the upper chamber so that it is tightly fixed to the lower receiver (i.e. no movement). Pour some stream water into the upper chamber (which must be rinsed with stream water before each new sample). Attention: the filter may clog more or less rapidly, and the upper chamber must be empty before the filter can be changed so try first with ca. 100 ml water in the upper chamber.

Filter water. When the lower receiver is nearly full (500-800 ml) and the upper chamber is empty, disconnect it and pour the filtered water from the lower receiver into the 5 l, duly labelled jerrycan. Pay attention not to allow any water to flow into the pump hose (the pump must not get wet or humid inside!).

Acidify sample through careful addition of dilute HCl (to inhibit $BaCO_3$ precipitation) so that the pH is 4.5-5. Mix thoroughly. Pour a subsample of the water into a small cap. Measure the pH of this subsample using the pH-paper provided. Discard the subsample thereafter.

Add 1/2 to 1 cap full of $BaCl_2.2H_2O$ crystals to precipitate $BaSO_4$. Mix well. The precipitate will make the water milky. If no precipitate is visible, proceed anyway.

Top-up container with additional filtered sample water and close it such that no air remains. Keep sample cool and in the dark, and send for S,O-isotope analysis (Univ. Calgary, labels provided).

Take a second sample at the same location so that it can be used either as a duplicate sample or combined with the first one if the water is very SO_4-poor.

If there is an accessible spring in the catchment, take one additional sample per catchment there.

FIELD MANUALS FOR REGIONAL SAMPLING 1995

These part of the field manuals was prepared for the fieldwork for the regional sampling of the "Eco-geochemistry Kola" project following a meeting in Espoo on the 24th November 1994.

During the regional sampling, several kinds of terrestrial media were sampled. These media included: podzol-profile, moss, humus and topsoil (for radionuclide analysis). The sampling sites were selected using base maps of general geology, vegetation zones, soil types, morphology and Quaternary deposits. The information given on the base maps was used to determine catchments of 300 to 500 km^2 in size. Within each catchment, a smaller (10 to 30 km^2) catchment was selected for sampling. The sample numbers were chosen in random order.

General selection criterias for sampling site for all the media: Sampling sites for all sample media are placed, where possible, in the centre of each catchment. Steep slopes, active river and stream channels and ancient lake or sea beaches should be avoided unless they dominate the catchment. Each sampling site must bee at least 300 m from main roads, villages or industrial sites and at least 100 m away from minor roads and houses. In more densely populated areas, these distances can bee reduced to 100 and 50 m respectively. All sample media have to be collected from the same 50 x 50 m area.

Areas which have been cleared, ploughed, drained or recently subject to fire are not suitable for sampling. The podzol profile sampling sites must first be located. If hills dominate the catchment topography, a podzol profile is located at the top of the hill or in the gently sloping areas. If the surface area of the catchment is dominated by low relief, the podzol profile is sampled in the gentle sloping area near the bottom of the hill or in the bottom of the valley. The parent soil type in the sampling area should be the same as the predominant superficial deposits dominating the catchment area.Superficial deposit types include moraine, glacio-fluvial or fluvial deposits, weathered bedrock acceptable till formation or weathered bedrock.

This manual includes the following instructions (author(s) in parentheses):

- Moss sampling (Matti Äyräs)
- Humus sampling (Marja Liisa Räisänen & Clemens Reimann)
- Topsoil (Clemens Reimann)
- Podzol-profile sampling (Galina Kashulina & Marja Liisa Räisänen)
- Field information sheet (Jo Halleraker)

The samples will be taken during the period 1st June - 31st August 1995.

TERRESTRIAL MOSS

Matti Äyräs

Selection of the sampling site: The moss samples should be collected around the podzol-sampling site chosen for this project. A suitable area for moss subsample collection is approximately 50 x 50 m. Each sampling point should be situated at least 5 m away from the nearest trees and 3 m from the nearest bushes, principally in small gaps in forests without pronounced influence from canopy drip from trees. On open heathland or peatland, the canopy of shrubs and large-leafed herbs and running water on slopes should be avoided. Samples should not be taken from boulders.

Sampling: Where possible, the species *Hylocomium splendens* should be collected. If this is not possible, *Pleurozium schreberi* may be collected. One composite sample, consisting of at least five subsamples, should be collected from each sampling site within an area of 50 x 50 m. In each composite sample only one moss species should be represented. Only the three latest green or green-brown annual shoots should be taken and every effort should be made to avoid mixing the sample with minerogenic matter and/or litter. The subsamples should be placed side by side or top against top in a large paper or plastic bags, carefully closed to prevent contamination.

The volume of moss sample needed is approximately 2 l uncompacted. The samples should be dried as soon as possible in a clean place at room temperature. The samples should be sent as soon as possible to the laboratory. In-transit contamination should be avoided.

CAUTION: When picking up the mosses, the use of disposable gloves is mandatory. Smoking is forbidden during sampling and handling of samples.

Reference:

The Environmental Monitoring and Data group of the Nordic Countries, The Expert Group for Heavy Metal Deposition, 1994. Monitoring of atmospheric heavy-metal deposition in Europe using bryophytes and humus samples as indicators.

HUMUS

Marja Liisa Räisänen & Clemens Reimann

Selection of the sampling site: For collecting the humus sample, the same area used for collecting the moss and topsoil samples should be used (i.e. 50x50 m). If possible, the podzol profile sampling site should be at the centre of this area. Each humus sample should be a composite sample from at least five (5) locations within the 50x50 m area. If possible, the humus samples should be taken at the same sites as the mosses. Where this is not possible, the sites should be located at each of the four corners of the 50x50 m square with the fifth sample taken at the centre on top of, or very close to, the podzol sample location. In any case, the minimum distance between any of the 5 subsample sites must be 5 m. Great care should be taken to ensure that the ground vegetation and the topographic situation at each of the five subsampling sites are comparable. All points should be selected at a

sufficient distance from the nearest trees to avoid "throughfall" precipitation from the trees (minimum 5 m from nearest tree and 3 m from nearest bush).

Sampling: The steel sampling tool with a diameter of 10.85 cm, supplied by NGU, is used for sampling. Using this tool, five subsamples are cored from the soil. The living surface vegetation, fresh litter and big roots and rock fragments should be removed wearing plastic gloves. The top 3 cm are sampled in all cases where the humus layer is thicker than or equal to 3 cm. To remove the top 3 cm from the rest of the profile use the stainless steel kitchen knife supplied by GTK. This will result in approximately 1 l samples - all samples should have this volume. In cases where many roots and/or rock fragments are removed from the samples, it may be necessary to take more than five subsamples in order to obtain 1 l of sample material. Put the samples into the white fiberglass bag labeled **"HUM...".**

At locations with a very thin humus layer (<3 cm), only the humus layer itself should be sampled. The mineral soil should be carefully removed using the stainless steel knife supplied by GTK and the thickness of the sampled layer noted. At such sites, it will be necessary to take more than 5 subsamples in order to obtain 1 l of composite sample. The number of subsamples actually taken should also be recorded.

TOPSOIL

Clemens Reimann

Selection of the sampling site: For collecting the topsoil sample, the same area used for collecting the humus and the moss sample should be used (i.e. 50x50 m). If possible the podzol profile sampling site should be at the centre of this area. Each topsoil sample is a composite sample from at least 10 locations from within the 50x50 m area. If possible the topsoil samples should be taken from the same sites as the mosses. The 10 subsample sites should be evenly spread over the 50x50 m area. Great care should be taken to ensure that the ground vegetation and the topographic situation at each of the ten subsampling sites are comparable and that the minimum distance between any two of the ten subsampling sites is 2.5 m. All sites should be located at a sufficient distance from the nearest trees to avoid "throughfall" precipitation from the trees in the samples.

Sampling: The stainless steel sampling tool with a diameter of 10.85 cm, supplied by NGU, is used for sampling. Using this tool, ten subsamples are cored from the soil. The living surface vegetation, fresh litter and big roots and rock fragments are removed wearing plastic gloves. The top five (5) cm are measured and taken as the sample. The thickness of the organic layer within these 5 cm should be recorded on the sample description sheet. Separate the top 5cm from the rest of the sample by hand (plastic gloves) or use the stainless steel knife supplied by GTK. Large rock fragments and roots should be removed from the sample in the field. Put the samples into the white fiberglass bag labelled **"TOP....".**

At locations where the soil layer is thinner than 5 cm, the whole soil layer down to bedrock should be sampled. The thickness of the soil layer should be recorded on the sample description sheet. In this

case, more than ten subsamples should be taken to keep the sample volume comparable to that from all other locations.

PODZOL-PROFILE

Galina Kashulina & Marja Liisa Räisänen

Selection of the sampling site: The homogeneity of the soil cover at a sampling site of 10x10 m^2 should first be checked using a spade drill or spade. Sampling should preferrably take place where the podzolic soil profile, underground vegetation and micro-topography are reasonably homogeneous. The trench for the sampling should be positioned so that, where possible, the working face is facing the light. The width of the working face should be 50-60 cm. Two or three smaller pits can be dug at a stony site or if podzolic layers are too shallow to collect sufficient sample material from one pit. In this case the appearance of the subpits should be similar. The depth of the pit depends on the location of the less altered layer but should typically be between 50 and100 cm.

Description of the profile: In order to distinguish the podzolic layers and mark the sampling layers, the working face should first be cleaned using a knife or spade using horizontal movements. Before sampling, the appearance of the profile should be briefly described using the main field sheet. If a more detailed description is considered necessary, the separate field sheet ("Podzol samling") should be used. Photographs of the profile, including a tape measure, should be taken and marked with the location number. Two more photos are taken; A general view of the bottom vegetation in the vicinity of the pit as well as one showing the general landscape. Distinctive features such as differences in layer genesis (sorting), large variations in the grain-size distribution and degree of cementation, should be marked separately on the sheet.

Sampling: Sampling should be started from the bottom of the trench. The sample of the parent soil should be taken from the bottom of the pit. The area sampled should cover the whole layer and samples are taken continuously from one layer to another (from the bottom of the trench upwards to the border of the humus layer). GTK's white paper sampling bag should be used (1 l of organic sample or 1-1,5 kg of mineral soil). Plastic gloves should be used for the humus sampling. Plastic spoons are used for the sampling of the mineral soil.

NOTE! Before taking the sample, each layer should be cleaned using a plastic spoon. If the layer sampled is well cemented, a spade can be used for removing a larger sample, from which the sample can be collected with a plastic spoon.

The following layers should be sampled:

Organic, humus layer (P1A): This material consists predominantly of decomposed plant residuals and accumulates under the litter layer. Vegetation, thick roots and undecomposed coarse rock fragments should be excluded during sample collection.

Eluvial, leached layer (P2E): The sample should collected from the layer showing element leaching. If the profile contains both a layer mixed with organic material and a grey-coloured eluvial layer, the sample should be a mixture of these two layers.

Illuvial, enriched layer (P3B): The sample should be collected from the layer showing enrichment of Fe and Al and organic compounds. If there are two illuvial layers (often a darker upper layer - maximum enrichment of organic Fe - and a paler lower layer - enrichment of inorganic Fe and Al), the sample should be a mixture of these two layers.

BC layer, transitional zone (P4T): The sample should be taken from the 15-20 cm below the illuvial layer.

Parent soil (C) layer (P5C): The sample should be collected from the face at the bottom of the pit (15-20 cm thick layer). The colour of the layer should be predominantly greyish or greenish grey.

Finally, the colours of the layers sampled should be recorded on the main sheet. Use the Munsell colour soil charts on the bag sample and not the pit face. For more detailed descriptions, the colour can be determined from the pit face.

LAKE WATER (Russia only)

NIVA - Tor S. Traaen

Selection of lakes:

If at all possible use the preselected lakes marked on th field map. If this is not possible select another lake of approximatelty the same size.
Small lakes should be first or second order lakes. There should be no bigger lakes upstream than the lake sampled.
For bigger lakes there should be only smaller lakes upstream of the lake sampled.
Mark newly selected lakes on the map and give them an identification number (map sheet number and lake number).

Sampling:

Samples should be preferably taken in the lake outlet.
Rinse the sampling bottle and screwcap 3 times with lake water prior to sampling.
Keep the bottlenecks 10 cm below surface for samling and point the opening towards the water current.
Fill one large (500 ml) and one small (100 ml) bottle at each site.
Avoid touching the inside of the bottles or screwcaps with your fingers.
Fill the bottles to the very top and squeeze out any air before closing the screwcap. Make sure that the bottle does not leak. Dry the bottles and mark them with the identification number and the date of sampling. Keep the samples cool and dark and deliver the samples as fast as possible to the laboratory.

SPECIAL TOOLS USED

In this chapter, short descriptions of the special tools used in the catchment study and regional sampling are given. These tools are:

- Snowpack sampler
- Stream sediment sampler
- Rain water collector
- Humus and topsoil sampler

SNOWPACK SAMPLER

In the catchment study, a special plexiglass tube was used to sample snowpack. The plexiglass tubing used is available commercially and is sold in 3 m lengths. These tubing lengths were cut to 1 m lengths at GTK. One end of each tube was then sharpened and a measuring scale with 10 cm intervals marked on the tube (Fig. 1). The inside diameter of the tube is 9.25 cm. Close to the sharpened end of each tube, holes were drilled through the tube so that a plexiglass plate can be used to retain the snow core. For storage and transport of the tubes, cardboard tubes with closeable caps were used.

When sampling the snowpack, the sampler is pushed vertically downwards through the snow cover (Fig. 2). The closing mechanism retains the snowpack in the tube and enables the thickness of snow cover to be measured. The sample can then be collected in a bucket or plastic bag. Where the snowpack is sufficiently well packed, the sample will stay in the tube without the use of the closing mechanism. Where the snowpack is loose, the sampling tube must be dug out and an extra plexiglass plate used to close the lower end of the tube.

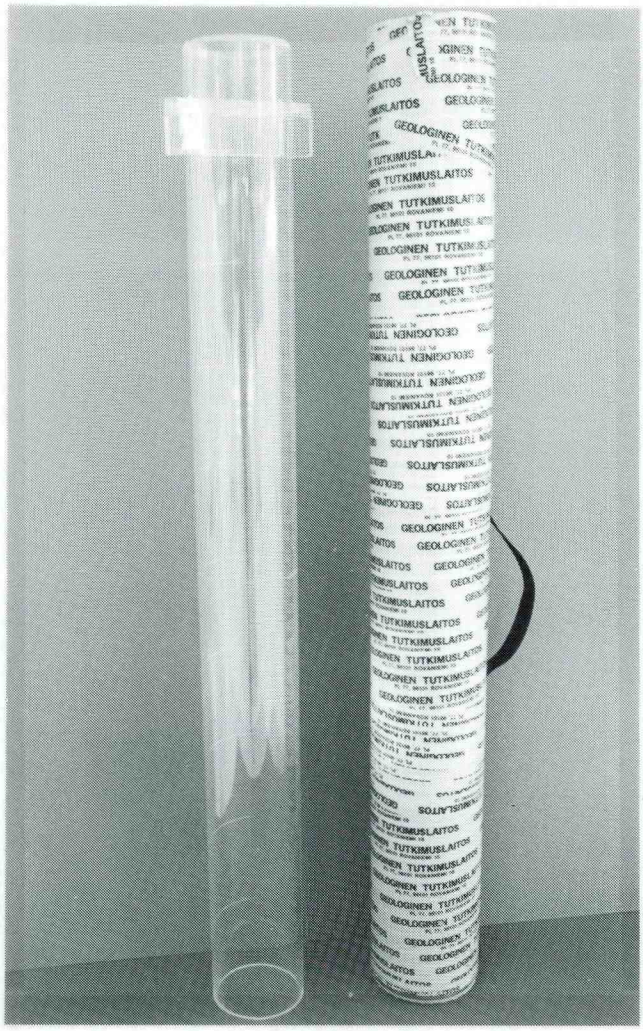

Fig. 1: Plexiglass tube used for snowpack sampling. Note the sharpened end at the bottom, the closing mechanism and the tube used for storage and transport. Photo: Reijo Lampela, GTK.

Figure 2

Fig. 2: Snowpack sampling in the field. Photo: Arve Misund, NGU.

STREAM SEDIMENT SAMPLER

The 0.125 mm nylon net from a butterfly net was used to make the organic stream sediment sampler in the catchment study (Fig. 3). The nylon net was sewn into the form of a bag and fitted onto a metal ring, which in turn was fitted to the top of a plastic tube. A wooden handle can be fitted onto this tube in the field. A plastic tube was used to strengthen the fastening of the net to the ring.

The suspended organic material can be removed from the bottom and/or the sidewalls of the river by stirring the water (Fig. 4). The net is then placed in the water and moved from side to side to collect the loose organic material. The material collected is then placed in a bucket, stirred and left some minutes to enable the coarse particles to settle. The wet organic material is then removed from the bucket using the net, pressed as dry as possible using a paper towel and the sample is then placed in a paper sample bag.

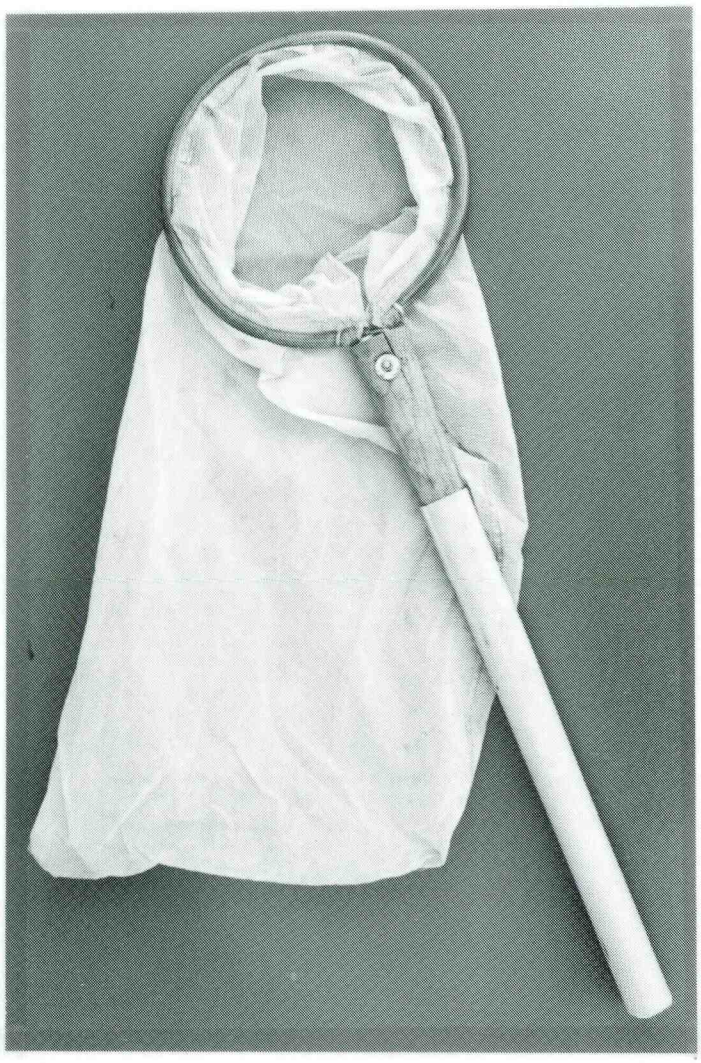

Fig. 3: Organic stream sediment sampling divice ("the butterflynet") Rhoto: Reijo Lampela, GTK.

Fig. 4: Sampling of organic stream sediments. Photo: Clemens Reimann, NGU

RAIN WATER COLLECTOR

Plastic tubes of inside diameter ca. 12.5 cm were used in the catchment study as rain water collectors. The design and construction of a prototype was carried out at NGU (Fig. 5). The dark grey tubing used is sold commercially in a variety of lengths. Lengths of ca. 40 cm were cut from this tubing. A plastic bag was installed inside this tube and fixed at the upper end of the tube. The plastic bag was closed so that the hole through which the water flows into the bag was minimized in order to avoid contamination and evaporation. The tube was then fixed to the end of a ca. 2 m long rod. In some cases the tubes were covered with aluminium foil to reduce external heating through sunshine.

Five of these sampling tubes were placed at each sampling station with three rain water collection stations per catchment. All points should be selected at a sufficient distance from the nearest trees to avoid "throughfall" precipitation from the trees (minimum 5 m from the nearest tree and 3 m from the nearest bush). Sampling should be undertaken as described in the field manual (see above).

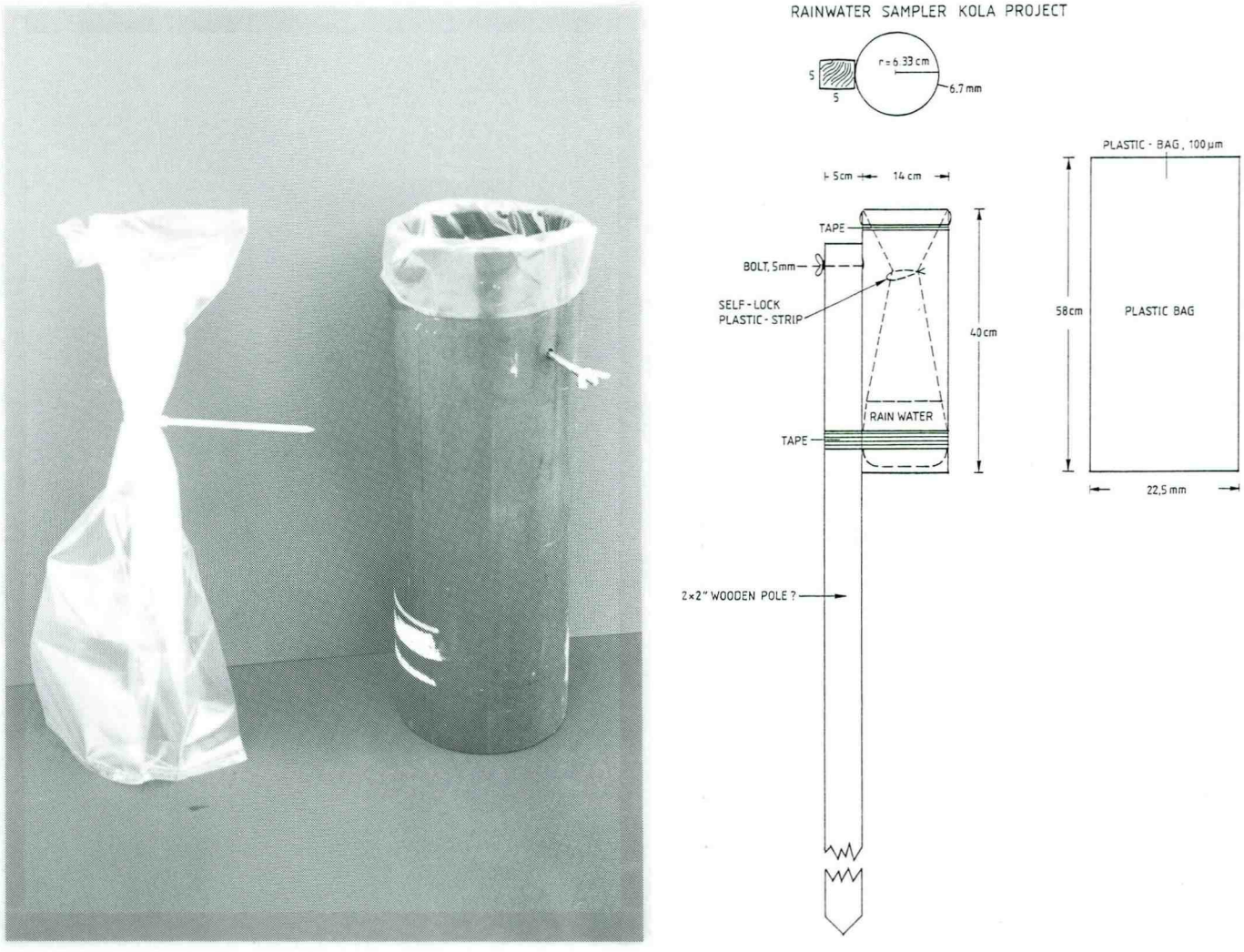

Fig. 5: Rainwater collector used for the Kola Project - construction drawing (Tore Volden, NGU) and photo (Reijo Lampela, GTK)

HUMUS AND TOPSOIL SAMPLER

In the regional mapping, a special cylindrical sampler, designed and made by NGU, was used for the sampling of humus and topsoil. The sampler is made of steel tubing (Fig. 8). The tube wall has an open slot about 3 cm wide. Along the slot, a scale with 1 cm interval is marked. The lower end of the steel tube is sharpened. For storage and transport the tube is placed into a styrox box.

When taking the sample (humus and topsoil), the steel tube is pushed and/or rotated into the soil. The thickness of the humus layer (uncompressed) and a 5 cm length of topsoil (as undisturbed as possible) should be measured using the scale on the tube before taking the sample out of the tube. Otherwise the sampling should be undertaken according to the field manual (see above).

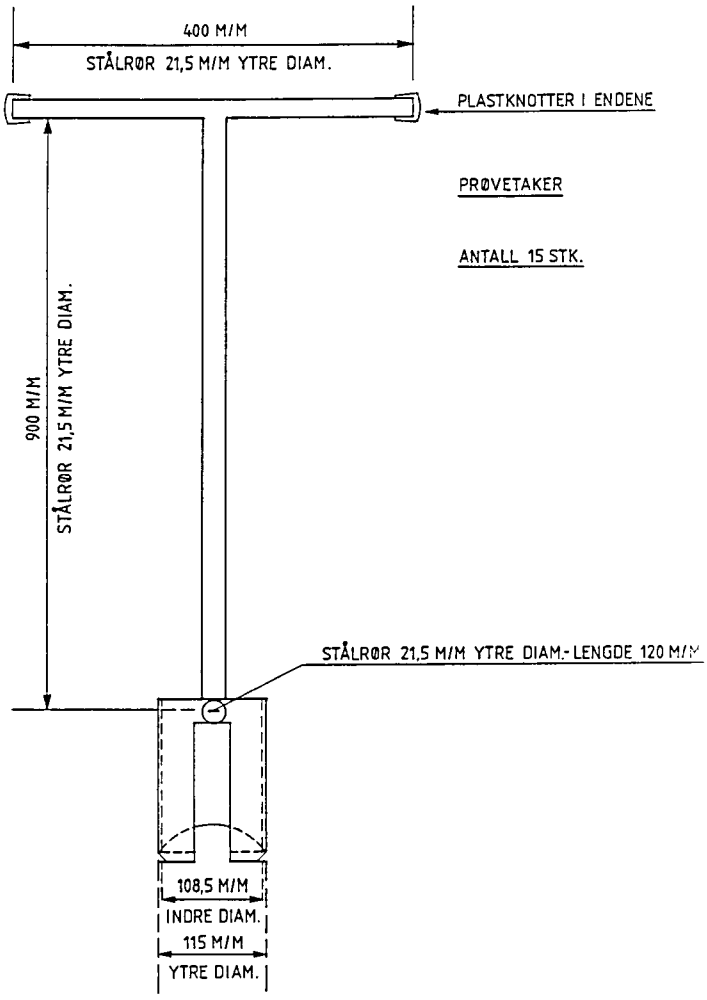

Fig. 6: Construction drawing of the soil auger used for collecting humus and topsoil samples for regional mapping. Tore Volden, NGU

FIELD FORMS

Special forms for collecting the field information were developed for this project. Appendix I shows the form used for the catchment study, Appendix II the form developed for the regional mapping and Appendix III a special form used for recording additional information from the regional podzol mapping.

Experiences from the catchment study made it necessary to write an extra chapter describing the categories used in the field form.

Description of field form categories - regional mapping 1995

The field form used for describing the sample locality is given in Appendix II.

Aspect: the direction which a slope faces. Record the direction down the slope as read on a compass.

General landscape (within approximately 200 m radius of sample locality):
* **Flat plain**: Generally flat landscape, but occasional features of up to 10 m relief (relative altitude).
* **Plain(s)**: Overall appearance of flat landscape, but occasional features of more than 10 m relief.
* **Ridge - hilly plains**: Overall appearance of ridges and hills, normally not more than 100 m relative relief in the area.
* **Deeply incised valleys:** Eroded landscape dominated by negative landscape features.
* **Slope (fjord-/lake-/valleyside):** Slope leading down to a basin (lake, ocean, fjord) or a river.
* **Low (block) mountain**: Relief 100 - 300 m in the area, elevation variable.
* **High mountain**: Relief more than 300 m in the area, elevation variable.

Topography (within approximately 10 m radius of sampling locality):
Gradient: record the angle of the slope at the locality using the clinometer of the geological compass. Steep: > 31°, Medium gradient: 11 - 30°, low gradient 1 - 10°.

Forest (within approximately 10 m radius of sampling locality):
Density; record the subjective density estimation of **T**= trees and **B**= bushes/ shrubs; divided in the classes **No, Some, Mean density** or **Dense**. Take into account the ground coverage from the canopy of bushes or trees when estimating the density at the locality, defined as percentage coverage of the sample locality; No < 1 %, Some 1 - 20 %, Mean density 21 - 60 %, Dense > 60 %. Trees are defined as >1.5 m high and bushes 0.3 - 1.5 m.

Note the Frequency [No (-) Few (**F**), Common (**C**), Dominant (**D**)] at the sample locality of the species: **Spruce** *(Picea* spp.*)*,**Pine** *(Pinus* spp.*)*, **Birch** *(Betula* spp.*)*,**Willow** *(Salix* spp.*)* or name of **Other species** of trees or bushes. Remember to record Birch and Willow even though the speciments may be very low (< 0.3 m high), mark no bushes but note presence of the species. Determine only one dominant species.

A relascope is a simple measuring in the forestry industry for tree counting. It consists of a 50 cm long chain with a small metal sheet at the end. Tree trunks are counted through a 1 cm slot cut in this plate.

Use of relascope: (see Fig. 7): Stand at the centre of the locality. As you rotate through 360°, count each tree which has a trunk diameter that fills the split in the relascope. The relascope should be used approximately 50 cm from your eye and pointed at each tree trunk 1.5 m above the ground. Move one step to the side if one trunk covers another. Record the number of trees counted as Rel.=xx.

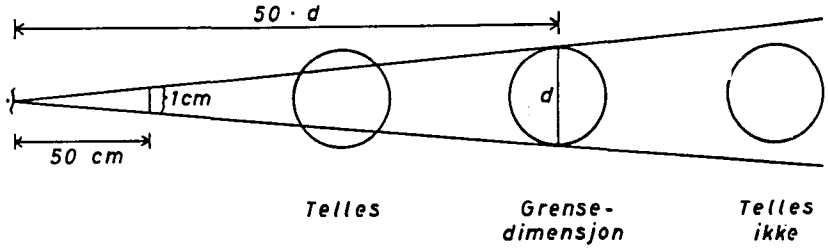

Fig. 7: The principle of a relascope. The circles refer to tree trunks. The left trunk and the one in the center are counted, the right hand trunk is not counted (from Fitje, 1989).

Estimate also the average height of the upper canopy of the trees and/or bushes Use the metre scale to get as good estimate as possible (Fig. 8).

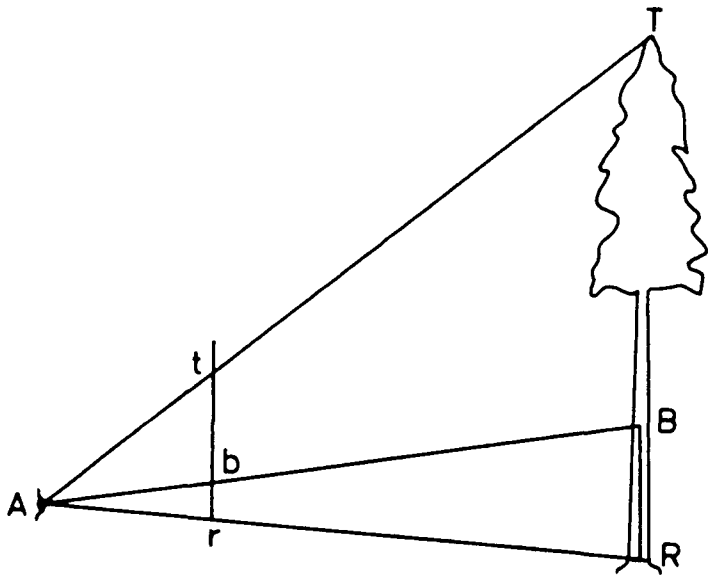

Fig. 8: The principle for estimating the average height of the upper canopy based on simila shaped triangles. "A" is the eye of the observer, "rt" represents the meter scale (from Fitje, 1989).

Ground vegetation (within approximately 10 m radius of sampling locality):
Note the frequency [No (-) **F**ew (F), **C**ommon (C), **D**ominant (D)]at the sample locality of the species;

Blueberry (*Vaccinium myrtillus*), **Crowberry** (*Empetrum spp.*), **Carlin heather** (*Calluna vulgaris),*

Grass including Sedge (*Carex sp.*) or name of **Other flowers** (flowering plants) e. g. Lingonberries

(*Vaccinium vitis-idaea)*, **Moss**, **Lichens**, **Pteridophyte** (Fern/*Filicales,* horsetails etc.).

Podzol profile (for Finnish part): Use the desciption in the field manual

Parent material of C-horizon (Q-deposits):
* Till: Unsorted material, glacially deposited
* Till mixed with saprolite: till mixed with visual portions of weathered material
* Saprolite (weathered material): in-situ weathered material (i. e. not transported).
* Fluvial/Glacio-fluvial: Sorted, commonly bedded material

Remarks: remember to record any unusual characteristics of a locality, such as evidence of a forest fire, vegetation damage, forestry or other human activity.

References:

Fitje, A. 1989: Tremåling. Landbruksforslag (in Norwegian).

DATE:_____ SAMPLE No.:_____

SAMPLER:_____ MEDIUM:_____

LOCALITY:_____ CATCHMENT No.:_____

EASTING:_____ NORTHING:_____

COORDINATE SYSTEM:_____ MAP SHEET NO: _____

ALTITUDE:_____ m IF DUPLICATE, TO NUMBER:_____

TOPOGRAPHY: ☐ Top of hill ☐ Slope of hill ☐ Break of slope ☐ Flat
☐ River or lake terrace ☐ Lake shore ☐ Bog shore ☐ Bog ☐ Flood plain ☐ Other, specify

FOREST: ☐ no ☐ some bushes/trees ☐ mean density ☐ dense
☐ Trees ☐ Bushes ☐ Mixed ☐ Conifers ☐ Deciduous ☐ Mixed

LAND USE: ☐ Forestry ☐ Recreational ☐ Agriculture ☐ Industrial ☐ Other (see remarks)

SNOW: Depth of snow cover:_____ cm
(average of 25 measurements)
Number of cores:_____
Sum of core length_____ cm
Ice layer(s) ☐ Yes ☐ No
Weight of sample _____ kg

STREAM WATER: Number of filters_____
Water level: ☐ low ☐ med ☐ high
pH_____ T_____°C EC_____µS/cm

RAINWATER: Days since last samp.: ___

Station	1	2	3
Number of bags			
Total Volume ml			
pH			
Cond. µS/cm			

ORGANIC STREAM SEDIMENT:
Number of subsamples_____
Water level: ☐ low ☐ med ☐ high

MOSS: Species ☐ *Hylocomium splendens*
☐ *Pleurozium schreberi*
moss cover: ☐ dense ☐ sparse
☐ regular ☐ clustered
appr. size of area sampled _____ m^2
weight of sample __ kg

TOPSOIL

Vegetation:
☐ moss ☐ lichen ☐ grass ☐ heath
☐ other, specify

SUBSAMPLE	1	2	3	4
On mineral soil				
On rock				
Mineral soil in sample				
Bleached layer in sample				
Thickness of topsoil cm				
Thickness of AO-horizon				

+ : = yes - : = no

REMARKS _____

Kola Project Sampling-95

Date: __ __ . __ __ . __ __ Sampler(s): _____ **Locality No.:** __ __ __
Y Y M M D D *Duplicate No.:* __ __ __
Sampled media: ❑MOS - ❑TOP - ❑HUM - ❑P1A - ❑P2E - ❑P3B - ❑P4T - ❑P5C (- if missing)

Easting: _____ Northing: _____ UTM Zone: _____

Map sheet No.: _____ Elevation: _____m. a.s.l. Country: ❑ NOR ❑ FIN ❑ RUS

Aspect: o N - o NE - o E - o SE - o S - o SW - o W - o NW - o Flat

General landscape:
❑ Flat plain ❑ Plain(s) ❑ Ridge - hilly plain ❑ Deeply incised valley(s)
❑ Slope (fjord-/lake-/valleyside) ❑ Low (block) mountain(s) ❑ High mountain

Topography:
❑ Hill top ❑ Concave hill slope ❑ Convex hill slope Break of slope: ❑Upper ❑Lower
❑ Rugged ❑ Steep ❑ Medium gradient ❑ Low gradient ❑ Flat ❑ Terrace

Forest:
No:_____ Some:_____ Mean density:_____ Dense:_____ (T= trees, B= bushes)
Spruce *(Picea sp.)*:___ Pine *(Pinus sp.)*:____ Birch *(Betula sp.)*:_____ Willow *(Salix sp.)*:_____
___Other;_____ [No (-) Few (F), Common (C), Dominant (D)]

Ground vegetation: [No (-) Few (F), Common (C), Dominant(D)]
Blueberry:___ Crowberry:____ Carlin heather:____ Grass:____ ___Other flowers;_____
Moss:___ Lichens:____ Pteridophyte:____

Terrestrial moss (MOS): ❑ *Hylocomium splendens* ❑ *Pleurozium schreberi*
Moss cover: ❑ Dense or ❑ Sparse and ❑ Regular or ❑ Clustered
Distance from podzol pit _____m. Minimum distance from tree ____m, from bushes _____m.
Approximate size of area sampled: _____m^2.

Topsoil (TOP): Humidity of samples: ❑ Dry ❑ Moist ❑ Wet No. of subsamples: _____
Thickness of organic layer (A_0): mean _____ cm, range from _____cm to _____cm

Humus (HUM): Humidity of samples: ❑ Dry ❑ Moist ❑ Wet No. of subsamples: _____
Thickness of humus : mean _____ cm, range from _____cm to _____cm

Podzol profile:

Parent material of C-horizon (Q-deposits):
❑ Till ❑ Till mixed with saprolite ❑ Saprolite (weathered material) ❑Fluvial/Glacio-fluvial
❑ Stratified/layered ❑ Fine-grained ❑ Gravel❑ Loose ❑ Compact

Layer	Lowest av. depth	Colour	Distinctive features/ variation in genesis of parent material
P1A			
P2E			
P3B			
P4T			
P5C			

Weather on day of sampling: ❑ Dry ❑ Showers ❑ Rain ❑ Snow Approx. temp: ___° C
Remarks:_____

*Sign.*_____

NGU Project No.63.2590.02

Podzol sampling - 95 NGU project 63.2590.02

Date: __.__.__ Sampler: _____ Map sheet: _____ **Locality No.:** ____
YY MM DD
Presence of stones/outcrops: % of surface: _____
Type of bedrock: _____
Type of soil: _____
Type of Q deposition: Till Till mixed with weathered material Weathered material Fluvial/Glacio-fluvial

Sample No	Hori-zon	Lowest depth	Variation thickness	Colour	Text-ure	Mois-ture	Compact-ness	Cemen-tation	Stones > 6 cm %	Stones > 6 cm shape	Gravel 0.2-6 cm %	Gravel 0.2-6 cm shape	Distinctive features:

General remarks:

Texture	Moisture:	Compactness:	Cementation	Shape of stones and gravel:
< 2 mm	Dry	Compact	N - no	Flat
Coarse Sand	Fresh	Slightly compact	FW - fragmented weak	Angular
Sand	Moist	Loose	FS - fragmented strong	Subrounded
Fine Sand	Wet		CW - complete weak	Rounded
Silty Sand			CS - complete strong	
Sandy Silt				
Silt				

Distinctive features:

Inclusion of:
strongly weathered mineral fragments (**SW**)
weathered mineral fragments (**W**)
Heterogenity of particles <2 mm:
thin (**Ln**), thick (**Lk**) layered alteration;
lenses or bands of finer (**FL**) or coarser (**CL**) sand

Heterogenity of particles > 2mm:
LH - little;
MH - moderate;
SH - strong.
Change of material (CM), cm