Rapport nr. 536

Preliminary notes on

QUATERNARY DEPOSITS

Tverrfjellet Area

Hjerkinn

NORGES GEOLOGISKE UNDERSØKELSE

Preliminary notes on the Quaternary deposits of the Tverrfjellet area, central Norway.

By Per Holmsen.

General.

The present geological map has been prepared on the basis of the official topographical map Fokstua - Kongsvoll, and upon a study of air photos provided by Folldal Verk mining Co. The air photos, scale ca. 1 : 10 000, are the series N° 901 by Widerö's Flyselskap og Norsk Polarfly, Oslo. The interpretations have been checked in the field during several days' field study.

That part of the area that is situated west of the railway line between Oslo and Trondheim is used as a military exercise field for artillery (and in part for infantry) units, except for the immediate surroundings of the Tverrfjellet mine. Admittance to this field is refused by the military authorities. However, during an interval, coinciding with the reindeer hunting, all passage is free. In 1963 this interval lasted from 1. to 25. of September.

The mapped area comprises the water divide between western and eastern Norway.

The ice divide of the inland ice was situated considerably south of the Tverrfjellet area.

The drift cover consists of ground moraine, ablation moraine, small eskers, gravel fans of late-glacial and post-glacial rivers, and peat deposits (bogs).

Characteristics of ground moraine.

The greater part of the area is covered by glacial deposits, which may be termed ground moraine. This term is applied to the material, contained within the bottom strata of the ice, which was deposited directly upon the bedrock. The local material dominates the ground moraine. The grain size distribution is even and ranges from clay matrix to boulders. The boulder content makes digging by hand tools very laborious. The top layer of the ground moraine contains frequent boulders of a more distant origin, indicating that the top material may, in places, have been transported for some distance. The surface of the ground moraine is even, much smoother than the surface of the bedrock.

The thickness of the ground moraine is mentioned in a separate chapter.

Crag-and-tail phenomena occur within the area, and a few prominent "tails" are indicated on the map.

Ground moraine is generalized on the map by oblique, openly spaced lines drawn in the supposed direction of the latest glacial movement. "Tails" are indicated by broken lines.

Ablation moraine.

This term is applied to the material which was situated upon the surface, or within cavities, of the ice during the last phase (the dead phase). In general it is difficult to distinguish deposits of this kind from ground moraine, and this is the main difficulty in mapping the area. Commonly the ablation moraine forms a thin cover, or scattered boulders only, on top of the ground moraine. In places, however, the ablation moraine forms small hillocks, supposed to represent the material brought into local depressions or cavities in the ice surface. The thickness in such places may amount to several meter.

The grain size distribution seems to be similar to that of the ground moraine, except for the fines. The material seems to be a little washed, possibly also locally transported, by melt water. In particular cases boulders are lacking.

Ablation moraine is generalized on the map by open rings.

Eskers.

A few eskers occur within the area. The material seems to consist mainly of layered sand and gravel of local origin. In the field they are easily recognized by their external form. Their situations are indicated by dots.

Alluvial fans.

Two small rivers run through the area, the Grisungbekken and the Svaani (Svåni). Along the Grisungbekken minor alluvial fans occur in several places, in particular in the lower part, near the confluence with the Svaani. Along the Svaani large glacifluvial terraces and alluvial fans occur all along its

course. The material, ranging from boulders to sand, has been transported by water in a direction very different from the direction of the glacial transport, namely towards east and southeast. In the central part of the mapped area a big alluvial fan of the Svaani interferes with a fan formed by the Grisungbekken, probably at an early post-glacial time, this term used here in a local sense.

Alluvial fans are generalized by small points.

The course of the Svaani seems to coincide roughly with a large drainage system that functioned during the very last stage of active glaciation, or rather at a time when the ice changed from being active into dead ice.

The material of the alluvial fans consists to a large extent of levelled ground moraine. The boulders and pebbles do not at large seem to have been transported for any long distances by running water, as indicated by the roundness degree. Possibly the finer material may have been transported for considerable distances by floods, in part, at least.

Peat (bogs).

Small bogs are common within the area, in depressions and in permanently moist places. The thickness of the peat deposits does rarely exceed one meter. The peat is usually situated upon ground moraine, but on the lower, sandy, part of the big alluvial fan between the Grisungbekken and the Svaani rivers some peat layers have been formed on the surface.

Bogs are indicated on the official topographical map, scale 1 : 50 000, but have been omitted on the geological map.

Direction of glacial transport and ice movement.

A study of glacial striae within the mapped area and its surroundings has revealed a rather complicated picture of the ice movement, the number of different orientations being fairly large. The oldest existing system points towards NW, in conformity with the general conception of the ice divide being situated far southeast of the area during maximum of glaciation. A younger system of striae, pointing NE, with considerable

variation (between 55^g and 78^g), is present in several localities. This system has been studied during recent years in connection with a general survey of the Quaternary of a wider area. The striae are supposed to originate from a later stage during glaciation, when an important glaciation center was situated within the high mountain area of Western Jotunheimen, far south-west of the Tverrfjellet area. The influence of this glaciation center reached this area, probably because the inland ice became dead earlier in the eastern than in the western part of the country.

The youngest glacial striae point towards N or NNE.

Glacial striae are indicated on the map by arrows, the tail at the observation point.

In order to investigate the latest movement within the area in question, a characteristic rock type of very local occurrence had to be located, and the local boulder transport from such a locality nad to be observed. No such rock type was found in the immediate neighbourhood of the Tverrfjellet mine. One had to go a distance from the ore body, and about 4 kilometer NW of Tverrfjellet a soapstone body was found in a crag named Haukberget. Haukberget forms a beautiful crag-and-tail-pattern. The soapstone has yielded very few boulders however, insufficiently to determine the ice movement accurately. However, the only existing glacial striae at this locality point towards ca 18^g, varying between 16^g and 22^g. Assuming that, on the weak rock type, any older glacial striae were obliterated by the latest active ice, one should expect that the direction 18^g represents the last movement of any importance. The few soapstone boulders found are in agreement with the assumption, as well as the orientation of the long axis of the ground moraine ridge on the lee side (the "tail") of the crag. The soapstone crag itself has got a distinct drumlinoid shape with the same orientation. All ciphers are corrected for error of the compass (which is ca $3^g W$).

Consequently, one should think that the most important glacial transport corresponded with this orientation. However, this may be strictly valid for this locality only. At the

railway station at Hjerkinn the youngest glacial striae point 0^g (true N), and one cannot exclude the possibility that the latest ice movement was local, varying in direction from place to place.

To some extent the older direction towards ENE may also be important in this connection, as a single ore boulder was found on the slope of the Hjerkinnhö mountain, NE of its supposed origin.

This apparent local variation of the latest glacial movement is also indicated by an observation from the Fokstua area, ca 17 km SW of Tverrfjellet, where the long axes of very regular (true) drumlins have the orientation of 65^g, indicating this to be the latest ice movement in that area.

This local variation may be explained by the fact, recently discovered, that the peripheral part of the inland ice covering the area, was active shortly before it disappeared. A distinct terminal moraine ridge can be followed for a distance of at least 15 kilometer, from the Kolla mountain over Nystuguhö and Knutshö mountains. This ridge is situated only 9 - 11 kilometer north of Tverrfjellet. The picture at the corresponding time seems to show a big glacier extending from the inland ice down the Drivdalen valley.

In any case, the latest glacial transport in the area is supposed to be between north and northeast.

Thickness of drift and sampling difficulties.

The thickness of the several kinds of deposits is known to a very limited extent only. By the diamond drilling operations, the ground moraine was penetrated, and is mentioned in the reports from a few sites only. These reports are the only sources of real knowledge at present. The vertical thickness (the reports give the oblique length) vary from zero to about 7 meter. In one place near the shaft the depth to bedrock is reported (by personal communication) to be ca 18 meter. Even if this cipher has not been verified, it seems probable that the thickness of the drift may reach a size of that order in lee side positions of crags.

Considerable difficulty is supposed to arise in obtaining deap-seated samples, because of the boulder content. The frequency of big boulders is so high that ordinary boring equipment for soil sampling is out of the question if samples are desired from greater depth than can conveniently be reached by ordinary hand tools, and a small excavator should be necessary then. Even if a such one is at disposal, the depth will be limited. Open pits will be filled with water very soon in sites where the water table is high. In order to get samples from greater depth than 3 or 4 meter one eventually may be forced to dig supported shafts.

Frost action and climate.

The frost penetration within the area varies locally and from year to year according to snow conditions. In ordinary years the snow cover will generally prevent the frost from penetrating deeper than one or two feet into the soil, and the frozen crust will be thawed as soon as by the beginning of June in most places, and one should be able to start sampling by that time. However, snowfalls may occur after that time also.

Solifluction phenomena are rather common, in particular in ground moraine and in places where the water table is high, less than one meter below the surface. Tussocks are common in certain bogs and on lower, sandy parts of alluvial fans where the water table is just below the surface.

The horizontal transport by solifluction seems to be short, probably not more than within ten meter.

Oslo, November 7, 1963.

Per Holmsen

(Per Holmsen)

1°10' West Oslo

62°15' N

Haukberget

Svaani

Grautbekken

Svaani

Road to Trondheim

Railway to Trondheim

Hjerkinn – hö

Grisungbekken

Tverrfjellet

Mine

Shaft

Field track

Vålåsjöhö

Old road

Hjerkinn st.

Road to Fåvidal

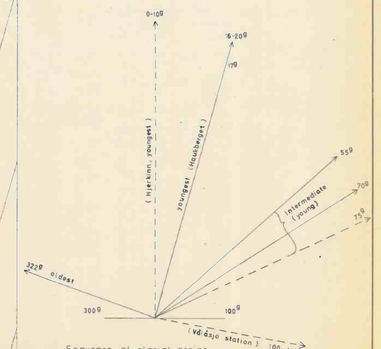
Railway to Oslo

Road to Oslo

1°10' West Oslo

SKETCH MAP OF THE QUATERNARY DEPOSITS OF THE TVERRFJELLET AREA.

by Per Holmsen



Sequence of glacial striae
360° = 400g

Dominating glacial local transport is ca 20g

LEGEND

- Ground moraine with drumlin (crag-and-tail)
- Ablation moraine, in part locally water-transported
- Esker
- River-beds and fluvial fans, Late glacial to sub-recent
- Frequent outcrops of bedrock, thin cover of ground moraine
- Glacial striae with observation point
- Contour interval = 30 meter

QUATERNARY DEPOSITS HJERKINN, Tverrfjellet area	MÅLESTOKK 1:10 000	
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B.23

B.21.

B.13

B.10.

B.

B.8.

N

LEGEND:

⊙ B Bore hole

Esker

Ablation moraine, partly locally transported by water.

Solifluction ridge, with transport direction

Direction of glacial transport

QUATERNARY DEPOSITS
HJERKINN, Tverrfjellet

MÅLESTOKK 1:2000

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