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GRØNLANDS GEOLOGISKE UNDERSØGELSE
BULLETIN No. 23.

GEOLOGICAL MAP OF
ATANIKERDLUK
AND ENVIRONS

1:10 000

BY

B. ESKE KOCH
AND
K. RAUNSGAARD PEDERSEN

WITH 11 FIGURES IN THE TEXT
AND 1 MAP

Reprint from
Meddelelser om Grønland Bd. 162, Nr. 4

KØBENHAVN
BIANCO LUNOS BOGTRYKKERI A/S
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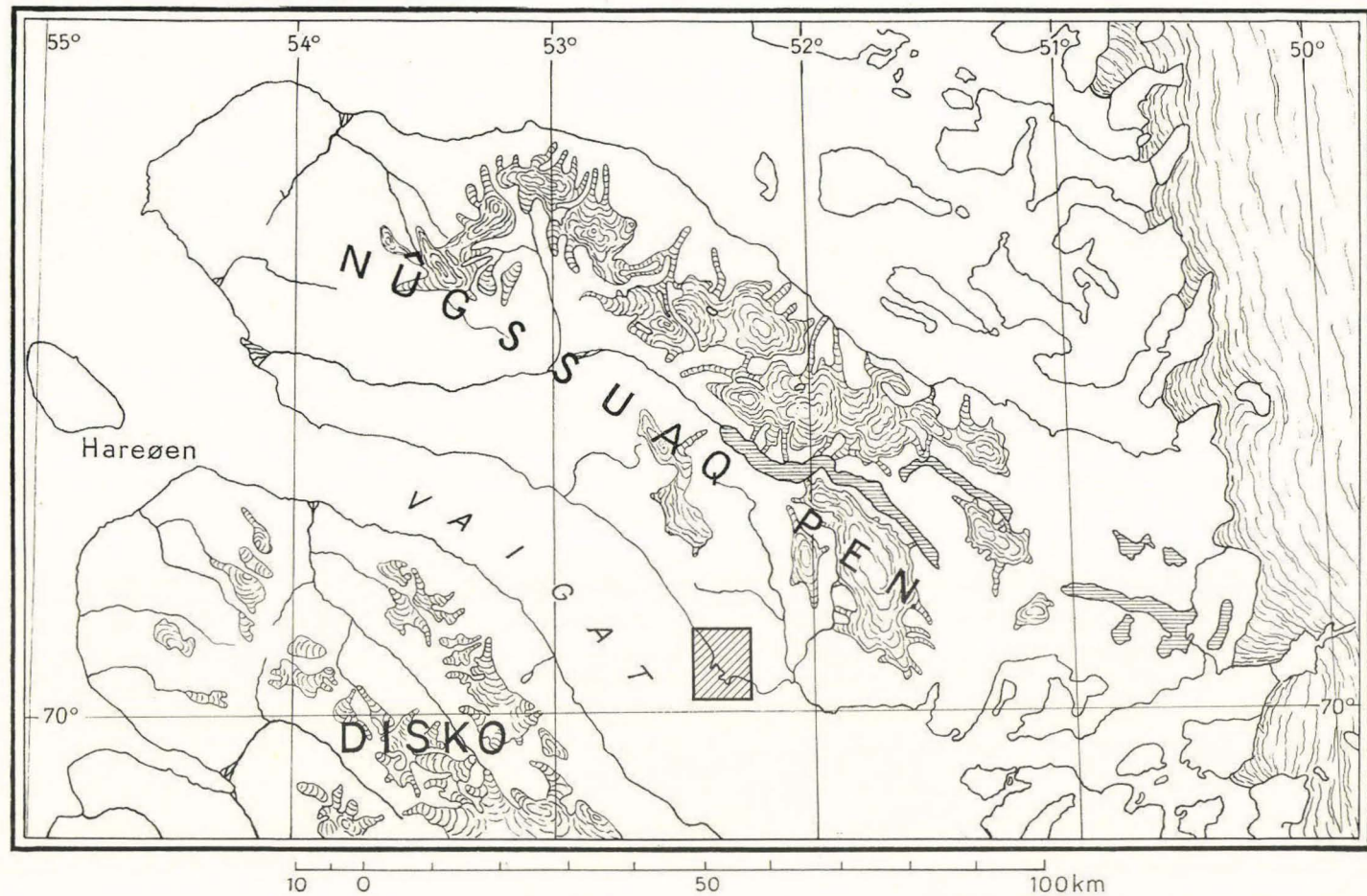


Fig. 1. Map of the Nûgssuaq peninsula showing the position of the geological map of this paper.

PREFACE

The unravelling of the geology of the Atanikerdluk area is one product of the geological investigations which since 1951 have been carried out along the south coast of the Nûgssuaq peninsula under the GEOLOGICAL SURVEY of GREENLAND.

The complex of investigations which under the leadership of professor A. ROSENKRANTZ were concentrated on the geological map NÛGSSUAQ, and which necessitated the unravelling of the geological conditions of the whole West Greenland sedimentary area in outline, led the senior author of this paper to the Tertiary occurrences of the territory round Atanikerdluk in 1951. Since, there has been worked in this field in the summers of 1952, 1954, and 1956 (B. ESKE KOCH 1955 and 1959). In 1956 the junior author commenced an investigation of the Cretaceous sequence along the south coast of the Nûgssuaq peninsula to obtain a micropaleontological-stratigraphical chronology.

The basic topographic map (70 V2, 1:10 000, Atanikerdluk) was made by the Geodetic Institute in 1951 for the Greenland Department under the Ministry of State in connection with the technical investigations as to the possibilities of utilizing the Cretaceous coal seams at Atanikerdluk. The appurtenant aerial photographs (at a height of 1500 m) have been used for the preparation of the geological map.

On account of a very extensive cover of loose soil and vegetation of a strongly varying character: from patch-wise occurrences through thin and faintly covering layers to greater thicknesses, and seeing that the necessary material of observation has not yet been collected the Quaternary, apart from the landslides, is not included. Two shades of the same colour have been used for each sign. The pure colours indicate occurrences observed, and a fainter shade indicates the extension below the Quaternary constructed on the basis of the observations made. Where the limit between the individual members is observed, it is drawn up with an unbroken line while the limits constructed are indicated by a hatched line. As, on account of erosion and Quaternary cover, the landslides do not all appear distinctly, and as the landslide areas on the whole are rather chaotic, it may not be expected that they will all be included on the map.

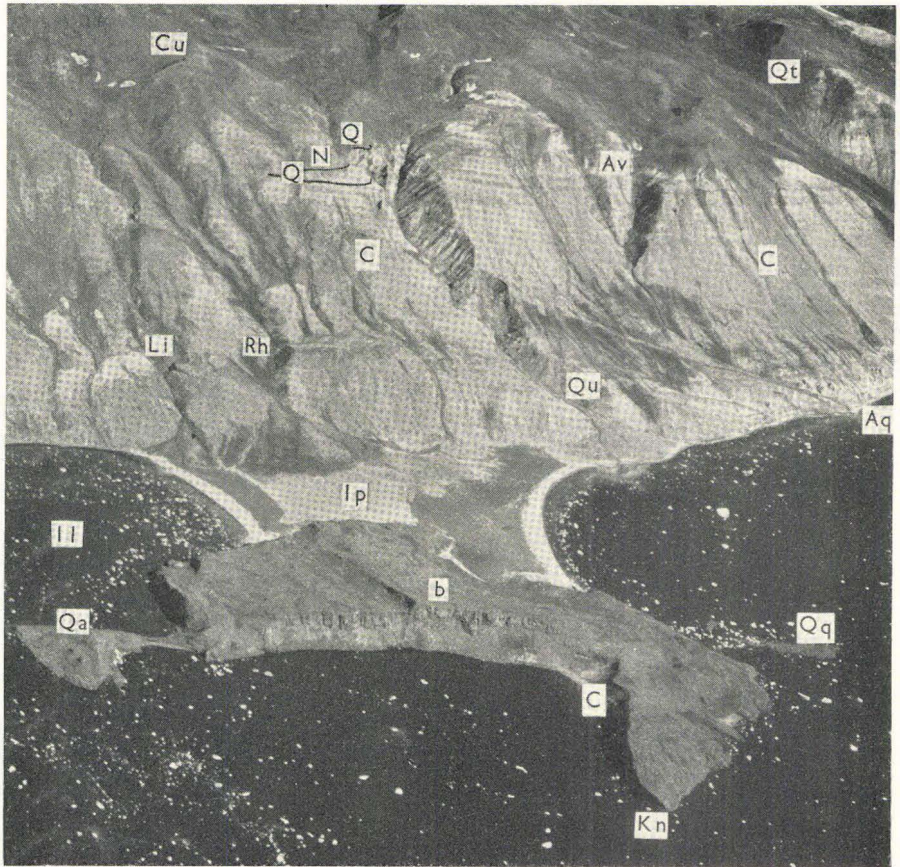


Fig. 2. Aerial view of Atanikerdluk and the coastal slope immediately to the north of the peninsula.

b: Basalt, C: Cretaceous Atane formation, Q: Tertiary Quikavsak member, N: Tertiary Naujât member, Cu: landslide coulisse.

Aq: Avqutdlugiaq, Av: Avqutdlugissap-kûa, Il: Iluarâ, Ip: Ipiutaq, Kn: Kangerup-nûa, Li: Liriodendronkløft, Qa: Qagssutit, Qq: Qeqertánguaq, Qt: Qernertuarssûp-kûa, Qu: Quikavsap-kûa, Rh: Rhododendronkløft. The black lines show the limits between Cretaceous, Quikavsak member and Naujât member.

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The most outstanding ones have been marked according to a tolerant judgment.

Cartography: H. F. RØHLING

Translation: ESTHER JACOBSEN

Photography: CHR. HALKIER.

Older geological investigations of the area were made by K. L. GIESECKE (1841), H. RINK (1851), R. BROWN (1868), A. E. NORDEN-

SKIÖLD (1870), K. I. V. STEENSTRUP (1871) and (1872), A. G. NATHORST (1883), E. VANHÖFFEN (1893), D. WHITE & C. SCHUCHERT (1897), and A. C. SEWARD (1921). In recent time investigations have been made under the Danish Nügssuaq expedition 1939 when S. MUNCK investigated the basalt intrusion at the Atanikerdluk peninsula (S. MUNCK 1945), and H. GRY, PH. D. made investigations of the sediments. Further historical information of the geological investigations at Atanikerdluk may be found in the senior author's paper from 1955 (B. ESKE KOCH 1955 pp. 8—16).

TOPOGRAPHY

The position 52°20' W, 70°05' N is near to the central point of the map which comprises an area of 6.5 × 8 km (ref. fig. 1).

The area is located at the coast of the southeastern part of the Nûgssuaq peninsula and belongs to the district of Jakobshavn in West Greenland (fig. 1). It is bounded on the southwest by the coastline (facing the Vaigat), and comprises part of the coastal slope of a mountain ridge which follows the coast from the Sarqaq dalen valley to Kingigtoq (ref. B. ESKE KOCH 1959 pl. 5). The crest of this ridge forms the north-eastern limit. On the east as well as the west it is bounded by lines running north to south through the coast at Qernertuarssûp-kûa and at the lagoon at Qagdloq.

The map has derived its name from the peninsula of Atanikerdluk, one of the few projections on the otherwise even coast of the Vaigat strait. Atanikerdluk (fig. 2) consists of an outer basalt rock the longitudinal axis of which follows the trend of the coast, and a low combined alluvial and marine sand and gravel plain called Ipiutaq which connects the basalt rock with the hinterland.

This SE—NW striking basalt rock reaches in the middle at the coastal cliff the height of 99 m (Ivnaq), is in the coastal direction 1.3 km long, and at Ivnaq 0.4 km wide. Towards NW the 50 m high rock Qagssutit forms a projection from the main part of the peninsula, only connected with this by a narrow ridge which shelters the small creek, Terqissap-atâ, located on the inside. On the south side of the peninsula a part of the basalt rock, abt. 50 m high, projects towards the west ending in the point Kangerup-nûa and giving Atanikerdluk the shape of a hook. On this part stand the remains of the former village Tupersuánguit. It is described by Rink in 1857 as being inhabited (RINK 1857). The ruins are also mentioned by Giesecke 1811, who describes the place as uninhabited (GIESECKE †1910). A number of grave mounds in the peninsula above the village remains gives evidence that here was once a built-up area before the Danish colonization was commenced. To the east of Tupersuánguit are the islets of Arqatigssat and Qeqertánguaq which besides give shelter to the anchorage east of Atanikerdluk.

The plain named Ipiutaq has no doubt its origin in alluvial and marine silting up under protection of the original island of Atanikerdluk. Both on the southeastern and the northwestern side there is a large lagoon bounded by beach ridges with but few outlets. The part of Ipiutaq lying between the lagoons appears as a naked gravel plain. Towards SW, along the basalt mountain of Atanikerdluk, there is in the plain a zone with lengthy sand dunes, 1—2 m high, with direction SE—NW.

On the western side of Ipiutaq, sheltered by Atanikerdluk, there is an excellent anchorage. The basin here is called Iluarâ, and it is moreover sheltered on the northwest by the small peninsula Nūnguaq. This peninsula is located $1\frac{1}{2}$ km NW of Atanikerdluk from where it stretches off shore abt. $\frac{1}{2}$ km in a southerly direction. It consists of a low, almost circular basalt rock hardly 100 m in diameter, and is connected with the hinterland by an isthmus similar to that of Atanikerdluk.

To the SE and NW of Atanikerdluk-Nūnguaq the coastline has an even course.

Behind the coastline the country rises steeply with gradient 1:3—2:3 up to an altitude of abt. 400 m above Iluarâ, and to the east and west of this basin up to altitudes of 500—600 m. Above Iluarâ, between the brook of the Liriodendronkløften gully and the gash of Siorqat-kûat, there is a shelf-like incision in the mountain the bottom of which has a smaller gradient between altitudes of abt. 400 and abt. 600 m with undulating topography of basalt hills, and between them winding brooks through marshy hollows. The configuration is rounded off as after weathering and erosion of long duration and with a good cover of vegetation, showing that the features of this topography may be traced back into early postglacial time. Behind this plain the slope of the mountain again rises steeply to an altitude of more than 900 m up to the crest separating the coastal slope from the cirque of Puiagtugssuaq. A similar topography is observed to the east at an altitude of more than abt. 500 m below the mountains of Iviangernat.

Between Siorqat-kûat and the easternmost of the gashes at Qagd-lūnguaq (B. ESKE KOCH 1958: Qagdlūnguaq SE) the gradient is steep (abt. 1:2) up to alt. abt. 600 m when it becomes less steep up to Keglen (Qagdlorssuaq). West of this mountain there is, above the altitudes of abt. 500 m to abt. 750 m, an area with a highly uneven topography with numerous big hills consisting of loose, rather fresh basalts, and without vegetation. Between the hills there are many funnel-shaped hollows; in this case a young terrain.

NW of Nūnguaq are clear-cut gashes with steep slopes stretching up to abt. 500 m above sea-level: Siorqat-kûat, Qagdlorssûp-kûa, two gashes at Qagdlūnguaq (B. ESKE KOCH 1959: Qagdlūnguaq SE and Qagdlūnguaq NW).

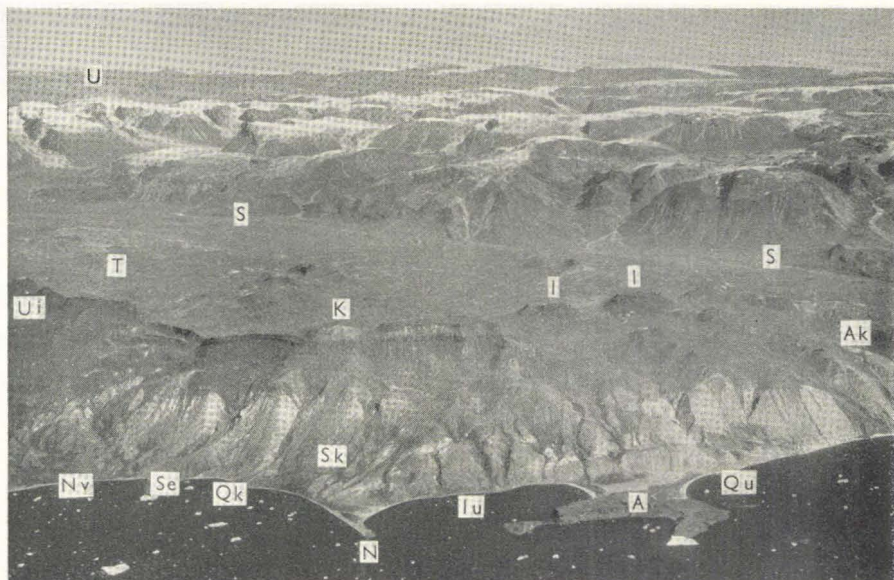


Fig. 3. Aerial view of Atanikerdluk and surroundings with localities referred to in the text. A: Atanikerdluk, Ak: Aussiviup-kûa, I-I: Iviangernat, Iu: Iluarâ, K: Keglen (Qagdlorssuaq), N: Nûnguaq, Nv: The ravine of Qagdlûnguaq NW, Qk: Qagdlorssûp kûa, Qu: Quikavsauup-kûa, S: Sarqaqdalen, Se: The ravine of Qagdlûnguaq SE, Sk: Siorqat-kûat, T: Tarajornitsoq, U: Umanak fjord, Ui: Umiussat.

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Beyond Iluarâ and Ipiutaq there are only smaller gashes and gullies, but immediately east of Ipiutaq and Atanikerdluk lies the big gash Quikavsauup-kûa which is bifurcated at an altitude of abt. 300 m. Within the map area there is further to the east another big bifurcated gash Avqutdlugissap-kûa which debouches at an altitude of abt. 200 m into a probably marine terrace abt. $\frac{1}{2}$ km across, covered with vegetation and with a lower gradient which is here facing the coast from an altitude of abt. 50 m, i.e. from the coastal cliff and upwards to abt. 150 m above sea-level.

The highest point of the map area is in the eastern part where two isolated mountains of 1033 and 992 m above sea-level are situated side by side and together bear the name Iviangernat. West of this and along the mountain ridge follows a number of peaks (the points 938, 976, 933 etc.) of which one in the western part is called Keglen (point 942) (Qagdlorssuaq), which in itself is the best description of the mountain: a cone with a circular basal area.

B. ESKE KOCH

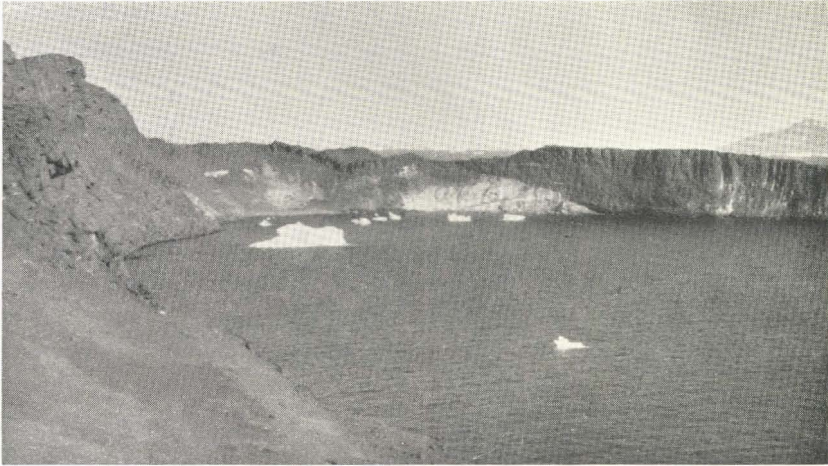


Fig. 4. The Cretaceous sediments N. of Kangerup-nûa, Atanikerdluk. K.R.P. fot.

GEOLOGY

Within the map area occurrences have been observed belonging to the periods Cretaceous, Tertiary, and Quaternary.

Cretaceous.

Atanikerdluk.

The Peninsula of Atanikerdluk (fig. 2) consists mainly of a Tertiary dolomitic sill (SOLE MUNCK 1945), but in the cliff to the south, facing the Vaigat, it shows minor outcrops of the underlying Atane formation (ref. TROELSEN 1956). The biggest is located in a section of the northwestern side of the hook with Kangerup-nûa (fig. 4) (SOLE MUNCK 1945 fig. 10). Here, along the creek, there is a cliff of quartz sandstone with beds of shale one of which is abt. 10 m thick and located between 10 and 20 m above sea-level. This layer is rich in impressions of fern leaves and must be what Steenstrup designates „Bregnelaget“ [the “fernbed”] (STEENSTRUP 1883). The sediments are here exposed from sea-level and up to an altitude of abt. 30 m at the head of the creek, but the occurrence wedges out strongly towards SW, and the overlying basalts reach sea-level already abt. 300 m NE of Kangerup-nûa. The occurrence is also traced in a northwesterly direction along the coast as far as or passing Ivnaq, but how far and of what thickness cannot be ascertained on account of talus of blocks of the overlying basalt. A similar section is located on the south side of Qagssutit facing the Vaigat. Sandstone is

exposed on a stretch of 100—150 m in the cliff along the coast where it forms some small points and reach an altitude of abt. 25 m before it is overlain by the basalts (ref. SOLE MUNCK 1945 fig. 9). The sandstone continues into the bottom of the sea in the creek.

Along the northeastern side of Qagssutit sandstones are observed in the bottom of Terqíssap-atâ, rising above sea-level as small outcrops in the beach. These softer rocks are also revealed by a ravine leading down to the shore where otherwise only the steep cliff of basalts is seen.

On the northern side of the peninsula, above the western lagoon, a few hummocks of sandstone occur representing the hanging of the intrusive.

The hinterland (fig. 2,3).

The area behind Atanikerdluk comprised by this map is the slope of the coastwise mountain ridge (fig. 3). It shows the sequence of the Atane formation (Cretaceous) consisting of alternating sandstones and shales from sea-level. The lower limit of the formation cannot be observed. The upper limit is visible in the northwestern part of the area from Siorqat-kûat to Qagdlúnguaq where it is overlain by Naujât member of the Tertiary Upper Atanikerdluk formation at an altitude of 500 ± 10 m (ref. the measurements for the lower limit of Naujât member page 20).

On the stretch between the Liriodendronkløften gully and the Quikavsauþ-kûa gash it is overlain by Quikavsak member of the Upper Atanikerdluk formation, a fluviatile member (fig. 8 ref. pag. 18). It fills in a fossil river-valley, which is here more than 100 m deep and is carved into the Atane formation in a period with negative epeirogeny preceding the Paleocene transgression, and this again is a consequence of the same positive epeirogeny as the deposits of Quikavsak member. For this reason the upper limit of the Atane formation is somewhat lower as, from abt. 480 m above sea-level in the Liriodendronkløften gully, it reaches its minimum SE of point 445 at altitudes of 345—350 m. In the eastern slope of Quikavsauþ-kûa above the big water-fall it again rises to 389 m above sea-level, and already abt. 600 m east of this place outcrops which are assumed to be part of the Atane formation are exposed up to an altitude of 495 m without the Tertiary being visible.

Between Siorqat-kûat and the Liriodendronkløften gully and east of Quikavsauþ-kûa, within the area of this map, the upper limit of the Atane formation is not visible. The limit shown on the map is estimated on the basis of scattered observations of the limit (NW and SE of the map these observations may be consulted in B. ESKE KOCH 1959) and the known average dip of abt. 7 m per km horizontal distance in a SE direction along the coast. This is an approximate figure justified by the experience of the even course of the limit outside the zone of influence of Quikavsak member revealed by the scattered observations from Kingigtoq to Sarqagdalen.



Fig. 5. Section of the western slope of Quikavsaup-kûa with the Cretaceous Atane formation. Obs. the small fault. K.R.P. fot.

The limit may therefore be encumbered by mistakes appearing as the difference in height between the ideal plain represented by the average and the plain represented by the real surface of the Atane formation.

As the lenticular structure dominates the deposit, it is difficult to present an exact measuring for the dip of the Cretaceous sequence but is assumed to be $10\text{--}15^\circ$ NE with strike abt. $N 140^\circ$ (B. ESKE KOCH 1955).

Along the coast clean sections are exposed in the cliff east of Atanikerdluk from Quikavsaup-kûa to Qernertuarssuk. The strata are here, according to the known eastern component of the dip, a recurrence of the sequence in the lower part of Quikavsaup-kûa.

The biggest section through the sequence east of Atanikerdluk is found in the gash Quikavsaup-kûa which crosses the sequence from 20—25 m above sea-level up to an altitude of abt. 400 m (fig. 5, 6). A

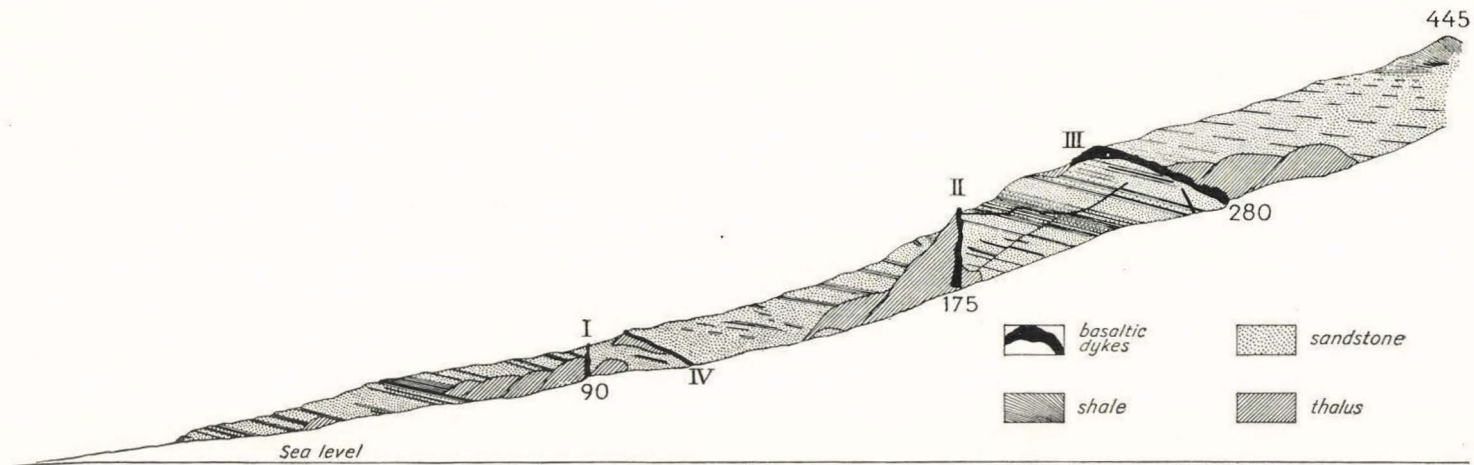


Fig. 6. The section of Quikavsaupekua drawn from Steenstrup's original sketch. 445: The hill with point 445 west of Quikavsaupekua.

description of this sequence was published by BROWN 1875 who records a detailed measuring. This gives a clear insight into the types of the sediments. STEENSTRUP 1883 renders a raw sketch of the section. A similar section, possibly the original of the above-mentioned, which was found among the effects he left behind, is shown in fig. 6. It is an extremely exact picture of the structure of the western slope of the gash though it suffers from lack of information of the dimensions (fig. 6);¹⁾ some heights, however, have been added to the present fig. 6.

Quikavsauþ-kûa exposes a continuous alternation of sandstones and shales in varying, but most often considerable thicknesses (10—20 m). The shale is often silty with mica, but also cleaner, bituminous shale occurs in minor thicknesses. Some thin coal seams occur in connection with the shales as demonstrated in the following table:

Coal seams in Quikavsauþ-kûa.

In the eastern slope; the big ravine along dyke III:

Alt. 372 m 10 cm coal. The same layer as at alt. 314 m in the section along dyke II and alt. 270 m below the waterfall.

Below the hill with point 445; the funnel-shaped ravine:

Alt. abt. 360 m Abt. 30 cm coal.

The ravine above the waterfall:

Alt. abt. 340 m Alternating coal and shale; the same stratum as mentioned above at alt. 360 m.

In the western slope:

Alt. 314 m Abt. 25 cm coal (assumed to be the same seam as the one mentioned in B. ESKE KOCH 1955 pag. 10 to be found in the gash below the waterfall at an altitude of abt. 270 m).

— 276 m 10—20 cm coal (above small sill).

— 142 m Coal in shale abt. 1 m in total.

The succession of the deposits is illustrated in fig. 4 showing part of the western slope of the gash above dyke II.

The succession is without any considerable anomalies, but minor flexures and a single minor fault are seen to cross the gash. The fault appears from STEENSTRUP's sketch (fig. 6) and can also be recognized on fig. 5. Its age appears from the fact that the basalt has been intruded into

¹⁾ Above dyke III it is incorrect, e. g. fails to show the unconformity between the Atane formation and the Tertiary Quikavsauþ member.

the fault from a sill (ref. fig. 6) and has been guided upwards by the fault. It is therefore older than, or simultaneous with the basalt volcanism. Thus, it is not a young fault related to creep phenomena and sliding of the coastal slope, but must rather be looked upon as one of several minor faults observed along and parallel to the coast as part of a fault zone connected with the formation of the Vaigat strait. However, the tectonic origin of this has not been proved so far. The sequence is crossed by several big dykes mentioned in the following.

On the stretch between Siorqat-kûat and Quikavsauþ-kûa minor outcrops of the Atane formation are found in the Liriodendronkløften gully and other minor gullies and ravines (fig. 2, 3). In the outlet of the Liriodendronkløften gully there is a shale bed abt. 60 m above sea-level, which by HEER was designated „Liriodendronlaget“ (the Liriodendron bed) (HEER 1883), discovered by A. E. Nordenskiöld as fossiliferous with, among others, *Liriodendron Meekii* Hr.¹) Some of the sandstone beds are strongly consolidated and appear in the coastal slopes as weathered hills or scarps, for example immediately W and SW of the hill with point 445 below the Tertiary strata. In other places it is the durable basalt dykes and sills which have resisted the erosion and protect part of the Cretaceous sediments which therefore stand out as exposures.

Between Siorqat kûat and Qagdloq there are 4 big gashes (fig. 3), which appear as big cuts through the Atane formation from abt. 100 m above sea-level and to its upper limit to the Tertiary shale designated Naujât member. The sequence is here as in Quikavsauþ-kûa an alternation of sandstones and shales and is best demonstrated in fig. 7 by the east side of the eastern one of the gashes at Qagdlúnguaq. Coal seams are here found as follows:

Coal seams in Qagdlúnguaq.

Alt. 468—470 m	Tertiary shale.
— 441 m	30 cm coal.
— 415 m	Thin coal seam of magnitude 20 cm.
— 312—313 m	30 cm coal.
	40 cm shale.
	40 cm coal
— 308 m	30 cm coal.
— 264 m	30 cm coal in shale beds only separated from the preceding shale bed by a thin sandstone bed.
— 260 m	20 cm coal in shale beds of 3—4 m.

Of these coal seams the one exposed in Qagdlorssûþ-kûa abt. 320 m

¹) rev. by Seward (1924): *Dalbergites simplex* (Newb).



Fig. 7. The eastern slope of Qagdługuaq NW showing the Cretaceous Atane formation in a section of abt. 300 m. K.R.P. fot.

above sea-level previously attracted attention, first in 1920 under professor BRETTING's investigations of which remains of the experimental "stolls" can still be seen. In 1951 experimental mining was commenced for the Greenland Department. Several "stolls" were in activity and are marked on the map. Above this seam Dr. J. R. DINSDALE in the service of the Greenland Department reports two other workable seams in Qagdłors-sûp-kûa at heights of abt. 350 m (48 cm) and abt. 370 m (58 cm).

Fossils: In his description of the fossils of the Atane formation (HEER 1882, 1883b) Heer also treats the species and their distribution in the localities: Bregnelaget (the "Fern bed") in the Peninsula of Atanikerdluk (see page 11), Liriodendronlaget (the "Liriodendron bed") (see page 16), the cliff east of the gash (HEER writes S of the gash. By "the gash" is meant Quikavsauþ-kûa) and Qagdloq (HEER: Kardlok) (HEER 1882, 1883b). Few of these species have later been revised. Some of them are treated by SEWARD 1925, SEWARD 1926, and SEWARD & CONWAY 1935 in a description of the plant fossils from Atanikerdluk, Qagdługuaq, and Kingigtoq.

According to Heer the fossil flora is typical of Upper Cretaceous and probably Cenomanian. This determination is essentially based on the knowledge of European fossil floras which is also the case with the wrong age-determination of the Tertiary strata, so one should hardly use them uncritically. Heer's material originates from the lower parts of the sequence at Atanikerdluk only, but NATHORST (ref. NORDENSKIÖLD 1885) found the flora at several levels in the formation and as far as the top of Quikavsauþ-kûa, which means that HEER's age determination must comprise the whole Cretaceous sequence at Atanikerdluk, with the above reservation.

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Tertiary.

The Tertiary sequence of the area rests unconformably upon the Atane formation (B. ESKE KOCH 1955, 1959) (fig. 8), and according to (HEER 1882) the whole sedimentary Tertiary sequence, adapted to the existing international nomenclature, is designated: *Upper Atanikerdluk Formation* (TROELSEN 1956). It is by the senior author divided into 5 members (B. ESKE KOCH 1959) as mentioned below, the youngest member at the head of the list:

Points 976 member
Aussivik member
Umiussat member
Naujât member
Quikavsak member

A brief description of these members beginning with the oldest, is given in the following.

Quikavsak member (B. ESKE KOCH 1959).

This member is not continuous within its area of distribution on the south coast of the Nûgssuaq peninsula, but appears as isolated occurrences owing to its deposition as an infilling of a "fossil" river-bed with a winding course (B. ESKE KOCH 1959) which in places crosses the south coast of the Nûgssuaq peninsula. One of these sections is part of the map area and reaches from Quikavsauk-kûa, where the most distinct outcrops occur round the hill with point 445 (fig. 8), to the Liriodendronkløft gully in the west (B. ESKE KOCH 1955 fig. 12).

The course of the Tertiary/Cretaceous limit is described in B. ESKE KOCH 1955 and treated in detail in B. ESKE KOCH 1959 with reference to the present geological map. From its easternmost occurrence in the east slope of Quikavsauk-kûa where the lower limit lies at an altitude of 395 m, it declines westwards attaining an altitude of 365 m in the west slope of Quikavsauk-kûa. The minimum is reached between altitudes of 345 and 350 m in a small gully southwest of point 445. From this place there is a constant increase westwards to an altitude of abt. 390 m in the most westerly occurrence observed in the west slope of the Liriodendronkløft. This section, the direction of which is rather east-west, thus traverses a depression in the surface of the Cretaceous. In the section, very nearly north-south, seen in the west slope of Quikavsauk-kûa, the limit keeps a constant altitude of 365—370 m. A groove in the surface of the Cretaceous traversing the coastal slope here is no doubt manifested (for further information ref. B. ESKE KOCH 1959 pp. 16—25).

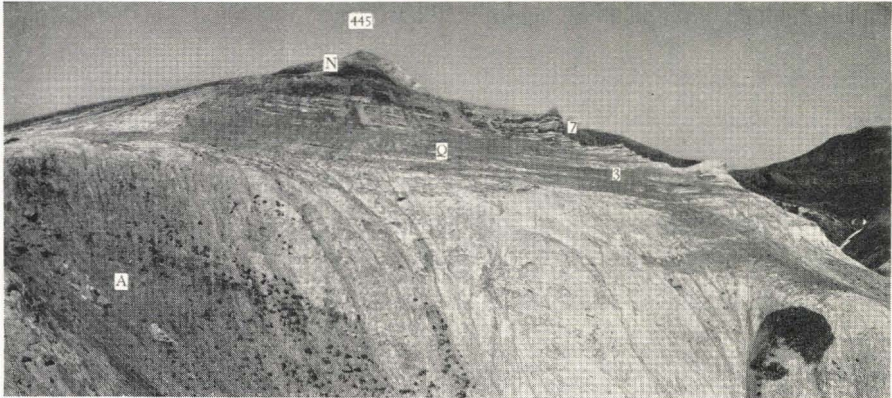


Fig. 8. The south slope of the hill with point 445 immediately west of Quikavsaup-kûa. A: The Cretaceous Atane formation, Q: Quikavsak member, (beds nos. 3 and 7 marked), N: Naujât member. B.E.K. fot.

That it is a subaeric erosion-carved surface, a former land surface, appears from the observation of the "fossil" weathering of the surface along the limit Tertiary/Cretaceous in the east slope of Quikavsaup-kûa (B. ESKE KOCH 1955 and 1959) with traces of podsolation.

The sediment consists of loosely consolidated sandstones and subordinate conglomerates of small pebbles alternating with thin silt to clay beds cemented by siderite to clay ironstone. Upon the Cretaceous beds follows abt. 1 m of sands and clays without distinct bedding. This is succeeded by abt. 25 m of coarse cross-laminated beds of sandstones abt. 1 m thick constantly alternating with max. 25 cm of sideritic shale-clay ironstone containing plant fossils (HEER: Upper Atanikerdluk A-flora, ref. HEER 1882, 1883b); the bedding here is distinct and of rhythmical character. Next follows a 2 m thick percurrent bed in which the lenticular structure is dominating: ochreous, cross-laminated lenticular sandstones entwined with lamina of shale. This sandstone bearing witness of considerable iron precipitation may be a brackish deposit (see B. ESKE KOCH 1959 page 60,83).

The upper limit of this sequence was ascertained to be at an altitude of abt. 400 m wherever it was observed in the area round point 445. As a whole it must be regarded a fluviatile member: coarse, cross-laminated sands and gravels with many plants and scattered insect fossils and with no traces of marine fossils. A detailed description of the profile as well as historical information is found in (B. ESKE KOCH 1955 and 1959).

This occurrence round point 445 at Quikavsaup-kûa is the type of *Quikavsak member*. The occurrence is by the senior author shown to be of the same age as the marine Tertiary in the Agatdalen (Angmartusut) in the interior of the Nûgssuaq peninsula which on the basis of the fossil fauna

is referred to Lower Paleocene (ROSENKRANTZ 1952). Quikavsak member can be followed along the south coast of the Nûgssuaq peninsula from this fluvial occurrence to occurrences with ingression of marine mollusc types which are common in the Lower Paleocene of the Agatdalen valley (B. ESKE KOCH 1959). Further, all these occurrences contain the same fossil flora "association" and occupy the same stratigraphic position in the Tertiary succession of the Nûgssuaq peninsula.

A small occurrence of coarse sandstone weathered into brown colours is found uppermost in the east slope of Qagdlorssûp-kûa. It is unconformably deposited upon the Atane formation and is overlain by the succeeding Naujât member. The thickness is abt. 2 m, and no fossils were found. Due to its position in the succession and its facies, the occurrence is referred to Quikavsak member (ref. B. ESKE KOCH 1959).

Naujât member (B. ESKE KOCH 1959).

This member is found partly in situ in the northwestern part of the map area (fig. 9) and partly in dislocated occurrences. The occurrences in situ, from Siorqat-kûat to Qagdlunguaq, are situated upon the Atane formation. The shale is unconformably deposited on the Cretaceous formation at altitudes as follows (ref. B. ESKE KOCH 1959 pp. 31—34):

In the west slope of Siorqat-kûat	490 m
Between Siorqat-kûat and Qagdlorssûp-kûa	504 -
In the east slope and at the head of Qagdlorssûp-kûa	514 -
The west slope of Qagdlorssûp-kûa	490—500 -
The eastern gash at Qagdlunguaq (Q. SE)	490 -

Only minor thicknesses are seen as stationary:

At Siorqat-kûat below the hill with points 587/592	60 -
At the head of Qagdlorssûp-kûa	80 -
In the eastern gash at Qagdlunguaq (Q. SE)	abt. 20 -

The other exposures are smaller. Everywhere the shale is upwards concealed by Quaternary deposits. It cannot be the total thickness that is exposed in the map areas as Naujât member has a total thickness of more than 200 m both to the east and to the west of this map and the stationary occurrences within the map area are overlain by landslides and other forms of Quaternary deposits which is most distinctly exposed in the eastern gash at Qagdlunguaq (Qagdlunguaq SE) (B. ESKE KOCH 1959 fig. 7).

Naujât member consists of black, bituminous shale. The basal layers contain thin lamina of a few cm consisting of a brown claystone which, apart from a considerable content of iron compounds, is characterized by



Fig. 9. Section of shale of the Naujât member immediately east of Qagdlúnguaq NW. K.R.P. fot.

a content of palagonite grains, consequently a tuff (B. ESKE KOCH 1959 pag. 25—26).

In the area between Siorqat-kûat and Quikavsauk-kûa there are several dislocated occurrences. Thus, on the area with an undulating topography which like a shelf lies in the mountains between Siorqat-kûat and the Liriodendronkløften gully, several of the hills nearest to the Vaigat appear to consist of black bituminous shale. This, for instance, is the case with the hill with point 493. The shale is here most often crushed, and thin clay ironstones may often be found with the character of being continuous, though broken. A similar occurrence is seen in the Liriodendronkløften gully abt. 400 m above sea-level immediately above the big dyke (II) which crosses the gully.

Of these occurrences the one in the hill with point 445 at the western margin of Quikavsauk-kûa is, however, the easiest accessible for observations in the section of the west slope of Quikavsauk-kûa. The shale is

strongly jointed and dislocated, though the original bedding is visible and shows a strong northerly dip (up to abt. 60°). Further, some small faults may be observed.

In the occurrence of Naujât member in the hill with point 445 (fig. 8), on the coastwise side, plant fossils were found (HEER 1883: "Upper Atanikerdluk B" flora) at an altitude of abt. 410 m in the brown tuff which is well-known from the basal layers of Naujât member on the south coast of the Nûgssuaq peninsula.

Uppermost in the hill with point 445 the shale is, by a faultlimit with tectonic breccia, separated from an abt. 10 m thick occurrence consisting mainly of sandstones with subordinate shales. In the southernmost part of the section in the west slope of Quikavsau-p-kûa this deposit shows a considerable dip (abt. 60°); the dip decreases evenly the more northerly one advances in the section of the gash, so that each bed describes an even bow from a steep northerly dip southernmost in the occurrence to an almost horizontal position northernmost (B. ESKE KOCH 1955 fig. 4). Whether this arenaceous deposit represents the transition strata between Naujât member and Umiussat member which can be observed at Aus-siviup-kûa by Tartunaq (east of the map area described in this paper) (ref. B. ESKE KOCH 1959 pl. 5), or whether it is part of Umiussat member itself cannot be determined definitely, but it is probable that it is one or the other of these possibilities.

In the northwestern part of the map area the lower limit of Naujât member can be observed. The limit for the remaining part, of which no observations were obtainable, is constructed theoretically by the heights of the limit observed at Siorqat-kûat, the section by the Sarqaq dalen valley (west of the map area), and the faint easterly coastwise component of the dip known for the south coast of the Nûgssuaq peninsula between the Sarqaq dalen valley and Ipeqarfûnge (west of the map area), with an easterly coastwise component of a decline of 7—8 m per 1000 m horizontal distance as basis.

The limit between Umiussat member and Naujât member was observed at Umiussat (west of the map area) and Naujât (Sarqaq dalen) (B. ESKE KOCH 1959), and it shows in average the same component of the dip in an easterly direction. On this basis the assumed limit for the map area described in this paper was constructed.

According to (B. ESKE KOCH 1959) the lowermost 10 m of Naujât member is referred to Lower Paleocene, the limit being but tentatively defined. Whether more of the overlying shale of Naujât member belongs to Lower Paleocene cannot yet be determined. Regionally the initial deposition of Naujât member can be correlated with the beginning of the "continuously eruptive" period of the basalt volcanism the first part of which is petrographically characterized as basalt breccia (SOLE MUNCK in ROSENKRANTZ et. al. 1940).

Umiussat member (B. ESKE KOCH 1959).

This member is not visible in its entire thickness within the map area, and its lower limit can only be assumed as mentioned in the preceding chapter of Naujât member. Exposures of Umiussat member are found in the steep slope which, between altitudes of 650 and abt. 950 m, towers above Nūnguaq and forms the northwesterly limit of the landslide area which appears like a shelf in the mountains between Siorqat-kûat and the Liriodendronkløften gully (fig. 10). Minor exposures of the member are visible in the lower part of the slope which for the greater part is covered with basalt talus. The sequence consists mainly of quartz sandstones with subordinate siltstones and shales. Exposures are seen from alt. 748 m to the upper limit of the member, bordering the Aussivik member 773 m above sea-level (B. ESKE KOCH 1959 p. 34).

West of the torrent of the Liriodendronkløften gully, in the wide landslide area, several landslides are found with yellow sand below basalts, and at Siorqat-kûat even one where the sand lies on black shale. They are probably dislocated occurrences of Umiussat member seeing that the basalt of the landslides in all essentials originates from the basalt level of Aussivik member as mentioned below.

Further descriptions are found in (B. ESKE KOCH 1955 (Upper Fluviate Series) and 1959 (Umiussat member)).

Aussivik member (B. ESKE KOCH 1959).

Aussivik member is found in the same steep slope as the above-mentioned exposures of Umiussat member which it overlies in the eastern part of the slope at an altitude of 773 m (fig. 10). The member consists of black, bituminous shale containing a huge zone of basalts. The basal layer consists of shales, though this part is only of inconsiderable thickness (773—780 m above sea-level in the eastern part of the steep slope). It is overlain by basalt in three beds the uppermost of which appears to be separated from the underlying one at maximum 10 m black, bituminous shale. This basalt horizon is of considerable thickness. In the eastern part of the scarp its lower limit lies at an altitude of 780 m, and the upper limit of the third bed on the same place at an altitude of abt. 850 m, consequently a total thickness of 70 m. The thickness of the basalt complex varies somewhat, thus it is only abt. 55 m in the western part of the scarp (ref. B. ESKE KOCH 1959). These basalts are by the author considered to be the oldest lava flows of the area. They are overlain by black, bituminous shale which can be followed as far as the interval at alt. 905—925 m. Less than one metre above the basalt a bed of brown tuff clay, several centimetres thick, is found here similar to the one known from Naujât

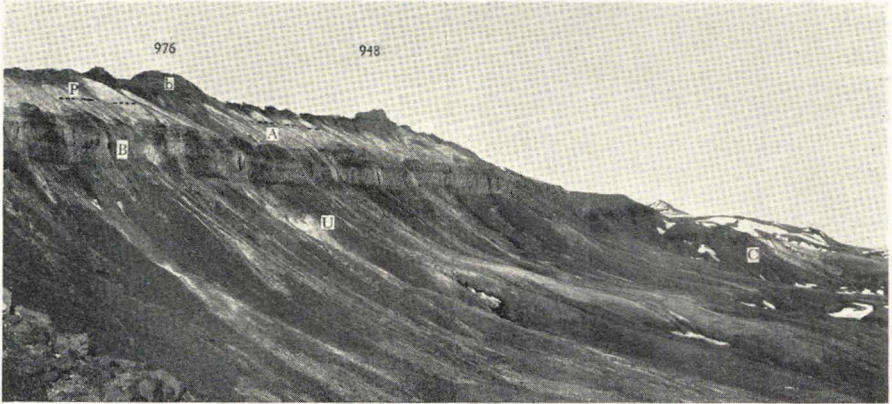


Fig. 10. The scarp with Tertiary outcrops above Iluarâ. U: Umiussat member, B: Basalt level of Aussivik member, A: Upper shale of Aussivik member, P: Point 976 member, b: Plateau basalts, C: Landslide consisting of (B). B.E.K. fot.

member. It has not yielded fossils within the map area. The top layers of this upper shale of Aussivik member consist of light, greyish brown shale.

The basalt level of Aussivik member can be followed westwards leaving the map at Qagdlorssûp-kûa and, though somewhat veiled by talus, distinguished eastwards as far as the pass between the two mountains called Iviangernat (points 992 and 1033) (fig. 3). The lower shale is only seen well-exposed in the eastern part of the scarp below point 948 and is visible in some places west of Keglen (Qagdlorssuaq). The upper shale of Aussivik member can be followed from ridge to ridge all through the scarp against Nûnguaq forming the basal part of the cone-shaped mountain Keglen (Qagdlorssuaq), up to an altitude of abt. 900 m. Further, on the aerial views of the Geodetic Institute from alt. 1500 m, on which the topographical mapping is based, a few minor exposures can be observed above the basalt level in the pass between the two mountains of Iviangernat. Even if the locality has not been visited, it is most probable exposures of this shale.

Point 976 member (B. ESKE KOCH 1959).

This member is a sequence consisting of coarser and finer sands which often show cross-laminations. It succeeds the shale of Aussivik member in the steep slope above Nûnguaq already mentioned (fig. 10). Here it appears at varying altitudes from 915 to 935—940 m determined by the lower limit of the Plateau Basalts with incline towards southwest. The upper part of Keglen (Qagdlorssuaq) consists of the sediments of Point 976 member, apart from a heap of basalt boulders on the top reminding of the former presence of the Plateau Basalts. In the scarp above the large

shelf-like landslide area above Nūnguaq it is visible from spur to spur all through the section. It may also be found in the pass between the two mountains of Iviangernat.

The Plateau Basalts.

The two large mountains of Iviangernat (points 970 and 1033) in the eastern part of the map consist of Plateau Basalts, which may be observed from an altitude of abt. 950 m; as the whole base of these mountains is covered with talus of basalts the lower limit is inaccessible.

Along the crest of the mountain ridge separating the coastal slope from the cirque-valley Puiagtugssuaq, and in whose steep, coastwise slope the above-mentioned sedimentary exposures are seen, there are a few minor basalt remnants, e.g. points 940, 940/948, 976, and 945. Behind this ridge there are other basalt mountains, e.g. points 938 and the bigger basalt mountain that forms the east side of the pass with the small lake at alt. 843 m. Finally, the summit west of Keglen, point 925, consists of basalt. This is located at a somewhat lower level than that of the Plateau Basalts ordinarily observed in the map area. Further to the northwest, outside the map, there are moreover indications that this place is not far from the northwestern limit of the "intrabasaltic" sedimentary occurrence, and that towards west at Umiussat it is replaced by basalt flows.

In the author's opinion the basalt level of the Aussivik member belongs to the Plateau Basalts genetically, and so the upper shale of Aussivik member and Point 976 member are intrabasaltic, not only stratigraphically but also genetically. But as the senior author has only been able to make probable, not to prove finally, that the basalt level of the Aussivik member consists of beds of surface lava, he has decided to describe them as belonging to Aussivik member to which it is stratigraphically bound.

Intrusions (Basalts.)

The peninsula of Atanikerdluk consists of an enormous sill and the country behind the peninsula is rich in sills and dykes of which several can be traced over considerable stretches.

Sills.

The biggest intrusion exposed within the map area is that of the peninsula of Atanikerdluk (fig. 2), which is part of a system that can be followed as far as the Sarqaqdaalen valley and from the outlet of this valley far into the country (full description in SOLE MUNCK 1945). The sediments underlying this sill appear on the outer coasts of the peninsula representing the sandstones and shales of the Atane formation, while the overlying part of this formation only appears as inconsiderable remnants

exposed on the northwestern slopes of the peninsula. About these sediments ref. page 11-12, and about the basalts ref. SOLE MUNCK 1945.

In the western slope of the Rhododendronkløften there is a sill abt. 5 m thick with its lower limit abt. 120 m above sea-level. It can be traced towards Quikavsaupekûa where it assumably continues as basalt intrusion IV. In Quikavsaupekûa it crosses dyke I and can be observed in both slopes. Basalt intrusion IV has the distinct characteristics of a sill. It crosses dyke I in the eastern slope abt. 120 m above sea-level and is only a few metres thick.

At the head of Qagdługuaq SE a sill, of a thickness of 3 m, was observed (basalt intrusion VIII) in the eastern slope. It is visible above the exposures of Naujât member abt. 515 m above sea-level.

Dykes.

Quikavsaupekûa is crossed by several big, almost vertical dykes (fig. 6). Dyke I crosses the brook-bed at an altitude of abt. 90 m (thickness 1—3 m), and its strike is 142° ; it is, as mentioned above, crossed by sill IV (B. ESKE KOCH 1955). About 175 m above sea-level the brook-bed is crossed by a dyke abt. 5 m thick eroded into the shape of a giant-staircase against both gash slopes (II). It can be observed towards SE as a low wall through the terrain till it reaches the coastal cliff 700 m east of the delta of Quikavsaupekûa (fig. 2, 3). Towards northwest it appears as erosional remnants, e.g. point 384, as far as the Liriodendronkløften gully which it crosses like a dam abt. 390 m above sea-level (dyke II). Its strike is N 160° .

In the western slope of Quikavsaupekûa above dyke II there is a big dyke forming a vertical wall through which the gash has been cut. The dyke has retarded erosion in the gash in such a way that the brook-bed shows a difference in altitude of more than 10 m between one side of the dyke and the other over which wall the torrent forms a fall down to 280 m. This dyke is visible over a distance down the coastal slope as erosional remnants and traces in the topography as far as immediately east of the outlet of the Rhododendronkløften with strike abt. N 77° . The thickness where Quikavsaupekûa crosses the dyke is abt. 10 m. On the map it is designated as dyke III (fig. 6; III).

As the crest of the spur forming the southeastern limit of Avqutdlugissap-kûa, a vertical dyke stands as a wall against the mountain slope (fig. 2). It is indicated on the map as dyke V, and as dyke II and III it appears directly from the contours on the map.

In the eastern slope of Siorqat-kûat a remnant is seen of an almost vertical dyke of a thickness of 1 m with strike N 24° , at an altitude of abt. 400—450 m, and in the western slope of the same gash immediately

at the entrance of an experimental stoll there is a small dyke (VII) with strike N 128° and dip 72° SW.

Between the two gashes at Qagdlúnguaq a considerable piece of a dyke (alt. 300—400 m) is exposed with strike N 128° (dyke IX).

All these big, steep dykes, many of which are vertical, are characteristic of the geology of this area as no similar dyke swarm has been found on the southcoast of the Nûgssuaq peninsula.

B. ESKE KOCH

Landslides.

(B. ESKE KOCH 1955 fig. 14), fig. 3.

It is a matter of taste whether this problem should be treated under the title Quaternary or under those members of the Tertiary to which the landslide "coulisses" belong.

The landslides consist of the various parts of the upper sequence of the area, especially basalts which for the greater part can be referred to the basalt level of Aussivik member (ref. this member), as dislocated blocks of this strongly columnar basalt can be traced stepwise down the slope; further, the shales of Naujât member, and sandstones underneath basalt or on top of shale, most likely belonging to Umiussat member.

The landslide "coulisses" occur over an interval of the coastwise mountain slope the ultimate upper limit of which is the basalt horizon of Aussivik member. Downwards there is no distinct lower level, but approximately the occurrence shows a noteworthy trend. Thus, in the southeastern part of the map area east of Quikavsauk-kûa, the lower limit is at an altitude of abt. 500 m; between Quikavsauk-kûa and Siorqat-kûat, the stretch facing the big shelf-like incision above Nûnguaq the topography of which is conditioned by landslides, such can be traced downwards to an altitude of abt. 240 m; some of the landslides lie, however, as low as at the foot of the mountain slope near the shore as, for instance, at Siorqat-kûat, and west of Siorqat-kûat above the big gashes at alt. abt. 500 m, and even higher.

The phenomenon of landslide "coulisses" is described in B. ESKE KOCH 1955. All the landslides which consist of sufficiently undisturbed rock mass show considerable dip towards the mountain slope away from the coast, the characteristic feature of landslides. In some places where shale of Naujât member is part of landslides there is sign of burning. As the phenomenon of ignition in landslides with bituminous shales is well-known from recent landslide action e.g. Pujortoq at Niaqornat, the explanation of the red shales is given (see further B. ESKE KOCH 1955 page 31—32). The greater part of the landslide "coulisses" are not yet overgrown with vegetation, and may be considered a relatively young phenomenon which from the present time through historical times can be

traced back to the last maximum glaciation. The landslides close to sea-level, of which there are but few (Siorqat-kûat: one, Qagdloq: a few) must be younger than the culmination of the last advance when a glacier has forced its way through the Vaigat and passed the Atanikerdluk peninsula, which is a distinct roché moutonnée attacked from east. This glacier would have removed these unconsolidated heaps. When it has withdrawn is not exactly known, nor is it possible exactly to determine the oldest possible date for these movements represented by the low-lying landslide "coulisses". But the great landslide action which has left the shelf-like incision above Iluarâ, has taken place after the glacier's withdrawal on account of the existence of low-lying landslides. The lack of landslide "coulisses" on the mountain slope east and west of Iluarâ, on the whole up to altitudes of 4—500 m (fig. 3), may also be ascribed to the action of this glacier. The clear mountain slope of a somewhat equal profile all the way along the even coastwise course must attempt one to assume this view (niviation) unless irregularities of a lower rank due to later erosions: frost, running water, wind etc. blurs the representation. On these stretches landslide action has ceased before the glacier regression.

About the very cause of the landslide movements can only be guessed. The basal part of the "mobile" sequence is black shales of Naujât member which may assumably have acted as a lubricant. The movement may have started by too big a gradient arisen by niviation leaving parts of the mountain unsupported by the melting of the supporting glacier. But there may also be deeper causes as for instance earth quakes in connection with the fault systems which are so amply represented on the peninsula of Nûgssuaq.

B. ESKE KOCH

Quaternary.

No marine Quaternary deposits are exposed, and neither has it been possible to show any terminal or lateral moraines. Moraine material is no doubt present in a considerable amount as accumulation of gneiss boulders were observed on the shore where marine erosion is active along the coast. Occurrences of the crystalline basement are only found east of this area and have not been observed until the Sarqaqdaalen (S. valley). No gneiss boulders, however, were observed by the author in the mountains at higher levels.

Ice scratches are distinctly visible in the Atanikerdluk peninsula which may be considered as a "roché moutonnée" attacked from the east (fig. 11). Especially on the eastern landward slopes, the rounded rock is well-preserved. Its sides are here almost polished and show distinct ice scratches from SE to NW.



Fig. 11. View from the stoss side of the Atanikerdluk peninsula with rounded and polished surfaces. B.E.K. fot.

Even if marine Quaternary deposits cannot be shown, it must be assumed that an essential part of the isthmus Ipiutaq which connects the Atanikerdluk peninsula with the hinterland, consists of marine and/or littoral deposits and beach ridges. The torrent from the Liriodendronkløften gully, whose alluvial cone is spreading behind Ipiutaq, has no doubt also participated in the conveyance of material. The strong winds that characterize the place, have through deflation smoothed the isthmus, which now appears as a flat gravel plain, and effaced all vestiges of the structure of the isthmus. The isthmus is limited to the hinterland by a low slope which may be interpreted as an overgrown cliff. On both sides Ipiutaq is bordered by typical beach ridges which protect a mud-filled lagoon, a characteristic feature which suggests a relatively rapidly developed upheaval which can be registered on the map area as the last epirogenic event. The mud is deposited by the water from the torrents of the Liriodendronkløften and the Rhododendronkløften which with their alluvial cones pointing to the isthmus no doubt contribute to the formation of this.

Solifluction is plainly active and on account of the considerable gradient it often appears as stripes of mobile matter with narrow skirts of vegetation on the sides. Actual polygons only occur in the high mountains and only in few places. Stone circles frequently occur in the high mountains and, at a lower level, in the plains between the strongly worn landslide coulisses in the eastern part of the map.

B. ESKE KOCH

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DANSK OVERSIGT

Geologisk kort 1:10 000 over Atanikerdluk og omegn.

Kortgrundlaget er fremstillet af Geodætisk Institut i forbindelse med undersøgelser af kulforekomsterne ved Atanikerdluk, som Grønlandsdepartementet tog initiativet til i 1951, og de geologiske iagttagelser er foretaget af forfatterne i forbindelse med den geologiske kortlægning på Nûgssuaq halvøen, som Grønlands Geologiske Undersøgelse har foretaget under ledelse af professor A. ROSENKRANTZ.

Det kortlagte område er 6.5×8 km og ligger på sydkysten af Nûgssuaq halvøen i Jakobshavn distrikt i Vestgrønland (se fig. 1).

Topografi.

Kortet omfatter halvøen Atanikerdluk samt et udsnit af den kystvendte side af den bjærgryg, som strækker sig langs Nûgssuaq halvøens sydkyst fra Sarqaqdalen til Igpigârssuaraq (fig. 2, 3). Atanikerdluk er en basaltklippe forbundet med baglandet ved en lav sandtange (Ipiutaq). Ca. 1½ km vest for Atanikerdluk skyder en mindre halvø, Nûnguaq, ud fra kysten. Mellem Atanikerdluk og Nûnguaq ligger et beskyttet bassin, Iluarâ.

Baglandet rejser sig til ca. 1000 m over havet, langs kysten til begge sider for Iluarâ med stejl gradient til 500—600 m, mens et stort indsnit i fjældsiden ud for Iluarâ ændrer topografien på dette stykke. Kystskråningen er her mindre stejl, og fra ca. 400 m er stigningen kun svag indad over en jævnt bølget slette, der ligger som en vegetationsklædt hylde i fjældet omgivet af stejle vægge mod V, N og Ø. Den nordlige begrænsning rejser sig stejlt fra 600 m til ca. 950 m til kammen af kystkæden. Vandløbene fører herfra til Iluarâ gennem mindre kløfter. Ø og V for dette indsnit er den stejle kystskråning gennemskåret af adskillige store skarpt skårne kløfter, som giver fortrinlige blotninger af den lagserie, som opbygger kystfjældene.

Ø og V for indsnittet over Iluarâ ændrer terrænet karakter over den stejle del af kystskråningen (over ca. 600 m). Øst for er terrænet meget ujævnt med uregelmæssigt spredte, tilskredne og tilgroede basalthøje med små, frodige sletter og afløbsløse lavninger imellem, idet der sam-

tidig er tale om en trinvis stigning op mod de basalttinder, der kroner kystkæden, og hvoraf to er særligt fremtrædende: Iviangernat. Vest for når kløfterne næsten ind til den basaltryg, som her danner kystkædens kam. Mellem kløfterne er der fra ca. 600 m rester af en jævn skråning med svag gradient op til denne basaltryg. Vestligere ud mod kortets vestrind bliver terrænet i denne højde meget ujævnt, idet der over kløfterne Qagdlunguaq og Qagdloq ligger et område med store nøgne høje af basaltblokke med afløbsløse lavninger imellem.

Foruden de før nævnte basalttinder findes der på kystkædens kam en enkelt høj fjældtop af sedimenter over Qagdlorssûp-kûa, som kan beskrives ved sit navn: Keglen (Qagdlorssuaq).

Geologi.

Indenfor kortet forekommer aflejringer fra perioderne Kridt, Tertiær og Kvartær. Der er tale om over 800 m sedimenter og desuden tertiære lavaer (basalt) som overfladedækker og som gange. Basaltdækker er kun bevaret med ca. 150 m's mægtighed. Basaltgange er til stede i stort tal.

KRIDT

Halvøen Atanikerdluk: Denne består af en basaltklippe 1,3 km lang og 0,4 km bred med længdeaksen parallelt med kysten. Det er en blottet laggang (sill) med nordøstlig hældning. De underlejrende sedimenter ses på sydvestsiden i bugten mellem Kangerup-nûa og Ivnaq: Kvartssandsten og bituminøs skifer (fig. 4). Mindre sandstensforekomster findes på Qagssutit og i bugten Terqissap atâ. Rester af den overlejrende sandsten findes som mindre klipper på nordsiden. Sedimenterne på halvøen tilhører Atane formationen, hvilket fremgår af plantefossilerne fra skiferen i blotningen N for Kangerup nûa (STEENSTRUP 1883: Bregnelaget, HEER 1883).

Baglandet: Landet bag Atanikerdluk (fig. 2, 3) opbygges fra havniveau af sedimenter tilhørende Atane formationen, hvis overgrænse ligger i varierende højder. I den vestlige del overlejres den af tertiær skifer (Naujât led) i ca. 500 m's højde (Siorqat-kûat, Qagdlorssûp-kûa Qagdlunguaq). Mellem Liriodendronkløften og Quikavsauk-kûa ligger overgrænsen lavere, idet de overlejrende flodaflejringer (Quikavsak led) er aflejret i en trugformet sækning i kridtsedimenternes overflade. Grænsen ligger i Liriodendronkløften 390 m.o.h., den når sit minimum S for højen med punkt 445 ved Quikavsauk-kûa, i vestsiden af Quikavsauk-kûa 360 m.o.h. og i østsiden er den steget til 390 m. Stigningen må tiltage betydeligt østpå, da Atane formationen når 445 m.o.h. 600 m østligere ved den lille bæk, der løber til Quikavsauk-kûa langs dyke III.

Atane formationen er en limnisk aflejring, der består af en stadig vekslende lagserie af lyse kvartssandsten og mørkegrå til sorte skifre, der ofte er sandede (fig. 5, 7). Desuden findes kullag, hvoraf nogle er brydeværdige, jfr. skemaerne over kullag p. 15, 16. Lagserien har nordøstlig hældning af størrelsesordenen 10° — 15° og dens opbygning ses af fig. 5-7. I lagene findes mange planteforsteninger (O. HEER 1882, 1883 b). Disse henfører lagsserien til *Øvre Kridt* og Heer har yderligere ment at måtte henføre floraen til *Cenoman*.

De største profiler, hvor kridtsedimenterne træder frem, er blottet i kløfterne Quikavsau-p-kûa, Qagdlorssûp-kûa og den østlige kløft ved Qagdlunguaq. Også i Siorqat-kûat og Avqutdlugissap-kûa og ved kysten Ø for Atanikerdluk ses dele af lagfølgen. Små blotninger findes i næsten alle lavere liggende kløfter, og på den stejle del af kystskrånningen ses overalt lyse pletter, som røber den kretasiske sandsten.

TERTIÆR

Den tertiære lagserie hviler diskordant på Atane formationen (jfr. fig. 8) og betegnes *Øvre Atanikerdluk* formationen. Denne formation opdeles i 5 led:

Punkt 976 led	(grovklastisk)
Aussivik led	(skifer)
Umiussat led	(grovklastisk)
Naujât led	(skifer)
Quikavsak led	(grovklastisk).

De første basaltdækker indgår i Aussivik led og Punkt 976 led overlejres af basalten (Plateaubasalten).

Quikavsak led.

Disse sedimenter forekommer kun blottet som mindre isolerede forekomster, idet der er tale om flodaflejringer, som udfylder en "fossil dal" eroderet i overfladen af kridttidsaflejringerne i slutningen af kridttiden. Kun hvor denne fossile dal, som har haft et noget slynget forløb, skæres af det nuværende relief findes der blotninger af Quikavsak led, og forekomstens nedre grænse beskriver derfor en bu. At grænsefladen skyldes erosion af en fortidig landoverflade fremgår af forvittringsfænomener i kridtlagenes overflade.

En sådan forekomst findes imellem Liriodendronkløften og Quikavsau-p-kûa. Blotninger findes i Quikavsau-p-kûa og de bedste i vestsiden under højen med punkt 445 (fig. 8). Undergrænsens forløb findes allerede omtalt side 33. Tertiærlagene hælder så svagt, at det ikke er direkte måleligt, så pålejringen ses tydeligt at være diskordant.

Quikavsak led består af løs sandsten med konglomeratiske partier med små rullesten vekslende med tynde, finkornede lag cementeret af siderit til lerjernsten i knolde eller med den skifrede karakter bevaret. I profilet i vestsiden af Quikavsauk kûa i sydøstsiden af højen med punkt 445 findes over grænsen til Atane formationen ca. 1 m sand og ler uden lagdeling men med kaotiske strukturer, der kan opfattes som forvitnings- og erosionsprodukter fra den oprindelige dalside. Herover følger en lagserie på ca. 25 m bestående af en vekslen af ca. 1 m tykke lag af grov, krydslejret kvartssandsten og maksimalt 25 cm tykke lag af sideritskifer og/eller lerjernsten, som indeholder mængder af planteaftryk (HEER'S Øvre Atanikerdluk A flora). Aflejringen har her en tydeligt rytmisk karakter. Herover følger et ca. 2 m tykt gennemgående lag, hvori linsestrukturen er fremtrædende: Okkergult, krydslejret sand i linser omslynget af skiferbånd. Herover følger endnu nogle få sandstens- og skiferlag til ca. 400 m.o.h.

Der er tale om en lagfølge af flodaflejringer. De øverste lag, der bærer spor af kraftig udfældning af jernforbindelser kan være brakvandslag.

En undersøgelse af tertiærets geologiske forhold i den sydlige del af Nûgssuaq halvøen har vist, at dette stratigrafiske led er jævndreng med de *paleocæne* sedimenter i det indre af Nûgssuaq halvøen (ROSENKRANTZ 1951, B. ESKE KOCH 1959).

En lille forekomst, der findes mellem Atane formationen og Naujât led i vestsiden af Qagdlorssûp-kûa regnes også til Quikavsak led. Der er tale om grov sandsten på ca. 2 m's mægtighed.

Naujât led.

Dette led består af sort, bituminøs skifer med enkelte brune tuffbånd i bunden. Skifrene forekommer dels faststående og dels som nedskredne, forstyrrede partier. De faststående forekomster findes i kortets vestlige del øverst i kløfterne Siorqat-kûat, Qagdlorssûp-kûa og den østligste af kløfterne ved Qagdlûnguaq. Forstyrrede partier, som har taget del i fjældskred findes i det hyldeformede indsnit i fjældet over Iluarâ samt i højen med punkt 445 vest for Quikavsauk-kûa, hvor det overlejrer Quikavsak led. En kaotisk dyng af denne skifer overlejrer ligeledes Quikavsak led i Liriodendronkløften N for dyke II.

Naujât leds samlede mægtighed er ikke blottet indenfor dette kort. Ved Naujât Ø for kortet er den 225—250 m og ved Umiussat V for kortet ca. 200 m.

I bunden af Naujât led findes enkelte brune tuffbånd, som indeholder planteaftryk (HEER'S Øvre Atanikerdluk B flora). Denne flora regnes nu for tilhørende NEDRE PALEOCÆN (B. ESKE KOCH 1959), hvortil man derfor i hvert fald må regne de nederste 10 m af Naujât led, som rummer denne flora.

Umiussat led.

Indenfor kortet findes kun blottet en begrænset del af den samlede mægtighed af dette led. Der er hovedsagelig tale om lys kvartssandsten med underordnede lag af sandet skifer. Blotningerne indenfor kortet omfatter den øverste del af den lagserie, der udgør Umiussat led, og de findes i stejlvæggen over skåret i fjældet ud for Iluarâ (fig. 10). Mellem ca. 748 og 773 m findes disse sedimenter blottet. Fuldstændige profiler findes ved Umiussat og Aussiviup-kûa over Tartunaq udenfor kortet, hvor den samlede mægtighed er 60 og 80—90 m.

Aussivik led.

Størstedelen af dette led findes blottet over Umiussat leds sandede facies i stejlvæggen over skåret i fjældet over Iluarâ (fig. 10). Der er tale om sort, bituminøs skifer med undergrænse ca. 773 m.o.h. og overgrænsen, som ikke er direkte iagttaget, ligger i intervallet 905—925 m.o.h. Skiferen omslutter en basalhorizont, 50—70 m tyk, bestående af 3 bænke. Mellem de to øverste findes der i hvert fald i en del af profilet ca. 10 m skifer. Disse basaltbænke antages at være områdets ældste lavastrømme og tilhøre Plateaubasalten (B. ESKE KOCH 1959). Få meter over basalhorizonten findes et brunt tuflag i skiferen, som er af samme type som de, der kendes fra Naujât led. Mindre blotninger af den øvre skifer menes også at forekomme ved foden af den vestligste af tinderne i Iviangernat. Basalhorizonten kan følges gennem hele kortområdet fra den vestlige til den østlige begrænsning, idet den dog øst for skåret i fjældet ud for Iluarâ kun gør sig gældende i topografien som en stejl skråning (fig. 3). Den nedre skifer kan findes under basalhorizonten, hvor den i hele den vestlige del af kortet findes blottet. Foruden i ovennævnte profil findes den øvre skifer i Keglen (Qagdlorssuaq).

Punkt 976 led.

Dette består af en lagfølge af grovere og finere sand ofte med krydslejring og stedvis med sandede konkretioner. Disse lag ses over Aussivik leds skifer i stejlvæggen over skåret i fjældet ud for Iluarâ op til 935—940 m.o.h. og overlejres af Plateaubasalten. De opbygger desuden den øvre del af Keglen (Qagdlorssuaq). Muligvis findes de også blottet i Iviangernat.

Plateaubasalten.

Denne lagfølge af lavabænke af basalt, som karakteriserer fjældene på Disko, Nûgssuaq halvøen og Svartenhuk kroner også fjældene indenfor dette kort, men i beskedent omfang. Over Iluarâ er der kun mindre rester levnet af erosionen, men østligere opbygger basalten de to toppe, som hedder Iviangernat, hvor mægtigheden er ca. 150 m. De tre første lavabænke indgår i Aussivik led (se dette).

Intrusioner.

Under basaltvulkanismen er der opstået et betydeligt antal basaltgange, såvel dykes som sills.

Sills: Den største intrusion af denne art er halvøen Atanikerdlúk, der er del af et system, som kan følges til Sarqaqdalen og langt op i denne (SOLE MUNCK 1945). Såvel de overlejrende som de underlejrende sedimenter findes blottet (se side 33). Desuden ses partier af mindre sills i mange blotninger f. eks. i Rhododendronkløften og herfra videre mod øst, hvor det formodentlig også er den samme sill, der skærer Quikavsaupekûa (IV). Ligeledes kan nævnes en flere meter tyk sill i østsiden af den østlige kløft ved Qagdlúnguaq ca. 515 m o.h.

Dykes: Denne type gange er meget almindelig i området. Flere store dykes, der står næsten lodret, skærer således Quikavsaupekûa (I, II og III) (fig. 6). Den ene af disse (II) kan følges fra kysten ca. 700 m øst for Quikavsaupekûa over kystskrånningen og denne kløft til Liriodendronkløften (fig. 2). En lignende stor dyke står som en mur og danner den sydlige begrænsning af Avqutdlugissap kûa. De vigtigste fremgår af kortet (I—IX) og de største må opfattes som tilførselskanaler til udbrudspalter, der har befundet sig i dette område. Der er usædvanlig mange gange igennem sedimenterne her, så at man kan tale om en gangsværm.

Skredkulisser.

Den ujævne topografi, der gennemgående findes over 500—600 m's højde og som også karakteriserer den slette, der danner bunden af skåret i fjældet ud for Iluarâ, skyldes fjældskred (fig. 3). De mange uregelmæssigt spredte høje er nedskredne partier (skredkulisser), og de består af basalt eller sedimenter. Basaltkulisserne kan væsentligst tilskrives Aussivik leds basalhorizont og sedimentkulisserne Aussivik leds skifer, sandstenen fra Umiussat led eller skifer fra Naujât led. Skredkulissernes øvre grænse ligger ved Aussivik leds basalhorizont.

Basaltkulisserne kan ofte have bevaret sin oprindelige lagdeling og bænken hælder da betydeligt mod N, d.v.s. ind i fjældet. De fremtræder derfor som høje, der rejser sig fra fjældskrånningen og har en lavning bagved. Øst for Iluarâ består basaltkulisserne af en sammenhængende basaltblok med den oprindelige struktur bevaret. De er stærkt tilgroede og må antages at være meget gamle. I kortets vestlige del over Qagdlúnguaq og Qagdluq er skredkulisserne meget stærkt forstyrrede og fremtræder som store dynger af basaltstykker. De er nøgne eller blot bevokset med mos og virker unge. Sedimentkulisserne er oftest stærkt forstyrrede, men kan dog som forekomsten, der opbygger højen med punkt 445 vest for Quikavsaupekûa, have bevaret lagdelingen nogenlunde. De er stærkt udjævnede af erosionen.

Det store skår i fjældet ud for Iluarâ skyldes betydelige skred, som har efterladt skredpartier helt ned til kysten. Således findes en skiferforekomst ca. 200 m o.h. og i dette skredområdes vestlige rand ved mundingen af Siorqat kûat ligger en sådan skiferforekomst mindre end 50 m.o.h. De lavtliggende skred må stamme fra tiden efter at Vaigat gletsjeren har trukket sig tilbage, mens de højtliggende tilgroede skredkulisser over rene og stejlt profilerede stykker af kystskråningen rimeligvis har været under dannelse mens denne gletsjer eksisterede eller før, hvorved skredmateriale både vest og øst for Iluara ikke findes lavere end 500—600 m o.h. (se side 32).

KVARTÆR

Ingen egentlige marine kvartære aflejringer findes, men en terrasse, som findes op til ca. 200 m.o.h., kan være marin. Kløften Avqutdlugissapkûa munder ud på den. Ingen egentlige moræner er konstateret, men morænemateriale er til stede i form af krystallinske blokke i betydelig mængde langs stranden f. eks. langs Iluarâ. De må være transporterede til fra øst, hvor grundfjæld først findes øst for Sarqaq dalen.

Under de kvartære aflejringer hører de, som opbygger tangen Ipiutaq. Den er et produkt dels af materiale tilført gennem Rhododendronkløften, hvis deltagegle munder ud bag tangen, dels marine aflejringer som følge af tilsanding bag Atanikerdlukklippen og dels strandvolde. Siden er en så stor del af sedimenternes finere fraktion blæst bort, så der kun er en stenet slette tilbage med en del lave klitter i læ langs nordsiden af Atanikerdlukklippen.

Atanikerdluk er en rundklippe med stødside mod øst, hvor polerede flader med skurestriber findes velbevaret (fig. 11). Isen er kommet fra øst, og baglandets kystskråning viser, når der ses bort fra de mange senere eroderede kløfter, et jævnt profil, der bliver stejlere opetter til 500—600 m.o.h., og som står rent og utildækket af kvartære aflejringer, herunder skredkulisser. Der må være tale om et profil, som er eroderet af en gletsjer, som må være kommet fra øst (jfr. Atanikerdlukklippen) (Vaigatgletsjeren), der altså her må være nået 5—600 m over den nuværende kystlinie.

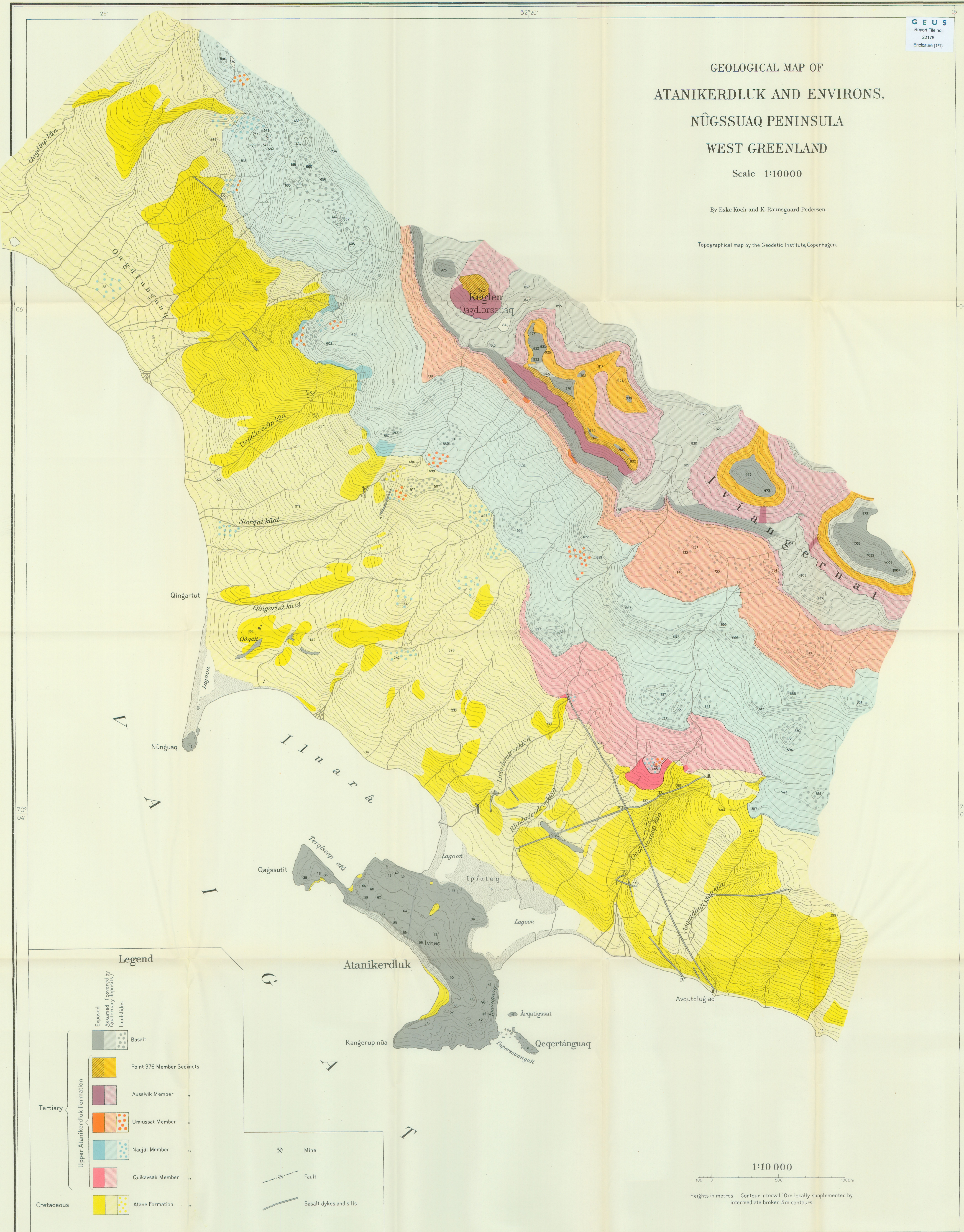
Jordflydning forekommer overalt, hvor der findes løsjord og flydejordens form afhænger af gradienten. Polygonjord og stenringe findes på fladerne i højfjældet.

GEOLOGICAL MAP OF ATANIKERDLUK AND ENVIRONS, NÛGSSUAQ PENINSULA WEST GREENLAND

Scale 1:10000

By Eske Koch and K. Raunsgaard Pedersen.

Topographical map by the Geodetic Institute, Copenhagen.



Legend

- Exposed (covered by Quaternary deposits) Landslides
 - Basalt
 - Point 976 Member Sediments
 - Aussvik Member
 - Umiussat Member
 - Naujât Member
 - Quikavsak Member
 - Atane Formation
- Tertiary
- Upper Atanikerdluk Formation
- Cretaceous

- Mine
- Fault
- Basalt dykes and sills

1:10 000

Heights in metres. Contour interval 10 m locally supplemented by intermediate broken 5 m contours.