GRØNLANDS GEOLOGISKE UNDERSØGELSE
BULLETIN NO. 8.

THE MESOZOIC SEDIMENTS OF QEQERTARSSUAQ, UMANAK DISTRICT, WEST GREENLAND

BY

HILMAR ØDUM AND ESKE KOCH

WITH 2 FIGURES IN THE TEXT
AND 3 PLATES

Reprinted from
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KØBENHAVN
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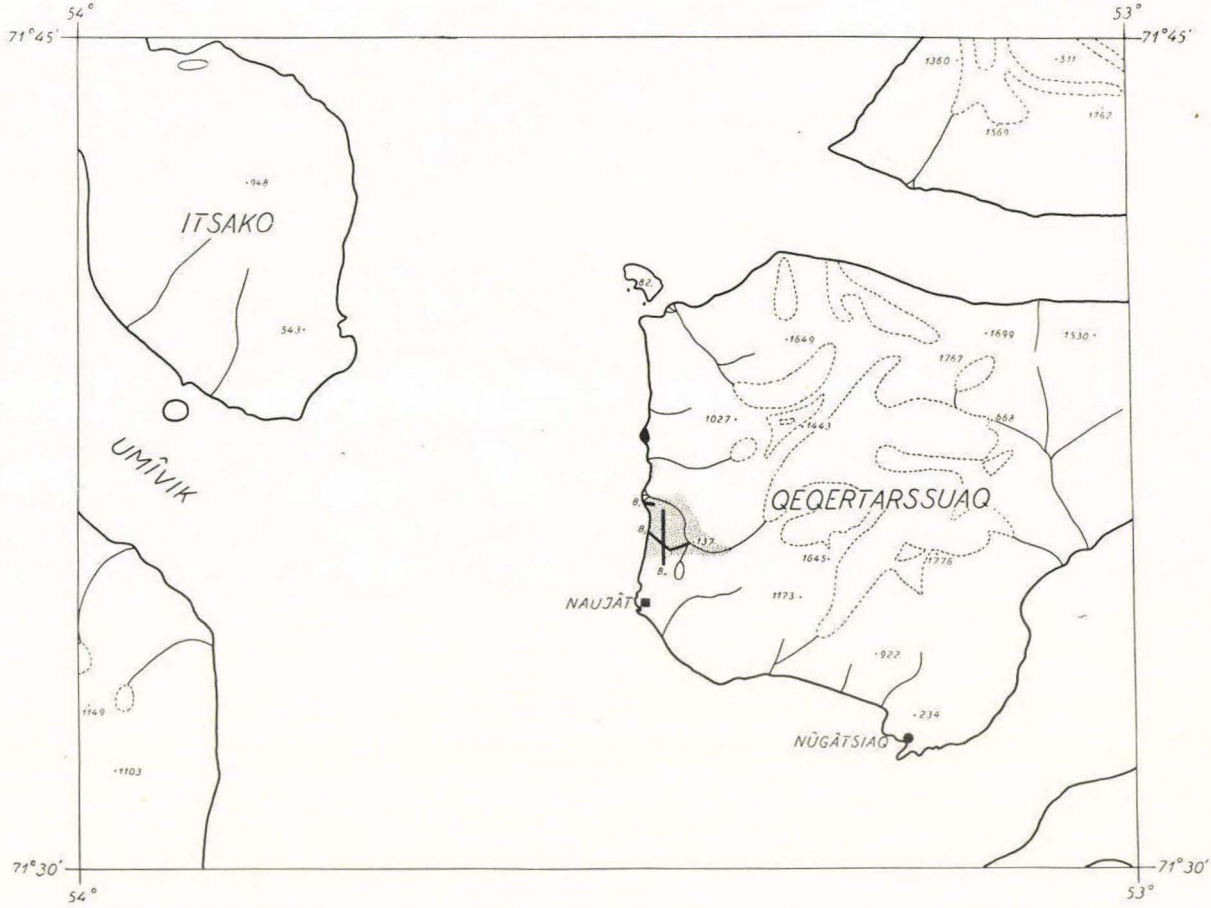

Fig. 1. Map showing the position of the sedimentary area (dotted) $B_1, B_2, B_4,$: Basalt dykes.

GEOLOGY OF THE AREA

By Hilmar Ødum

In 1947, during the work of the Geological Survey of Greenland in the Umanak District of West Greenland, Hilmar Ødum and Eske Koch—under the leadership of A. Rosenkrantz—investigated a small sedimentary area on the west side of Qeqertarssuaq in Karrats Fjord, about 4 kilometers north of the settlement Naujât (ref. fig. 1). The existence of sediments here was established in 1929 by Lauge Koch (1929, page 259), who, however, was not in a position to undertake a closer examination.

A glacial stream runs through the middle of the sedimentary area discharging to the west, where it forms a delta of considerable size; at an elevation of 137 meters this stream receives a tributary from the south which drains a small lake. The glacial stream divides the sedimentary area into northern and southern parts extending a little more than one kilometer north of the delta, and a similar distance south of the delta. The inland extension of these sediments could not be accurately established because of soil cover, but is at least 2—3 kilometers. The northern part does not attain any great altitude, rising evenly from the coast to the east. The southern part rises steeply because here cut by basalt, a north-south "main dyke" which attains an altitude the sediments are of somewhat over 300 meters, may be particularly mentioned. A number of smaller dykes and sills are found in both the northern and southern parts of the sediment area.

The Section North of the Stream.

The conspicuous coastal section north of the stream is the most important; it is about 600 meters long, and attains an elevation of about 40 meters above high-water level (fig. 2) (pl. 3 fig. 2).

The main structural features of the section are shown in pl. 3 fig. 2; the following details can be mentioned:

All measurements are reckoned from an arbitrarily chosen Station O, where the section was fairly clean in 1947; basalt and sand-

stone scree is, however, seen until 50 meters to the south. The basalt occurs as a sill, whose thickness could not be determined, uppermost in the cliff.

Station 70 m north. (All elevations are above high-water level). Top of cliff, about + 30 m (paulin altimeter); the abovementioned basalt disappeares..

14.80—+ 30.00 m:	Sandstone, yellowish-white, banked and bedded.
13.20—14.80 m:	Sandstone, fine-grained, dark, argillaceous, shaley.
11.70—13.20 m:	Sandstone, yellowish-white, coarsely bedded.
8.90—11.70 m:	Sandstone, black-violet, argillaceous and highly micaceous, finely shaley. A persistent concretionary bed from 90—100 cm above the base of the bed.
4.90—8.90 m:	Sandstone, yellowish-white, coarsely grained and coarsely banked, streaked with pea-sized quartz grains; in the middle of the bed a 10 cm thick layer of more finely shaley, darker sandstone.
2.00—4.90 m:	Sandstone, black-violet, highly micaceous, finely shaley, with occasional thin beds of light-coloured sandstone, especially in the uppermost 50 cm.
0.00—2.00 m:	Sandstone, yellowish-white, coarse and coarsely banked.

Station 225 m north:

Immediately above the beach a 2.30 meter thick bed of dark sandstone, coloured by carbonaceous particles, bedded and shaley; the uppermost 15 cm developed as a conglomerate with rolled pebbles of fine grained sandstone, quartzite, gneiss, phyllite, etc. The bed is broken by several small faults. At two places the following (deceptive) measurements of the faults were made:

Strike N. 2° E.	Strike N. 80° W.
Dip 50° W.	Dip 56° S.

ESKE KOCH has measured the dark bed itself, at the base:

Strike N. 70° E.
Dip 23° SE.

The bedding is, however, a little irregular. The dark bed contains carbonaceous particles, a few fragments of wood, and "worm" tracks, but no determinable fossils.

The dark bed is here over- and underlain by coarse and coarsely bedded, pale sandstone.

Station 325 m north.

The above mentioned dark bed disappears at a fault at an elevation of + 28 meters (paulin altimeter).

Fig. 2. The section north of the stream, north of Naujat, Qeqertarssuaq. (ØDUM fot.).

From this station northwards the beach is covered with fallen blocks of sandstone; some contain rolled quartz pebbles, all are coarsely grained and coarsely bedded with rusty streaks; ripple marks were observed at one place.

Station 415 m north.

26.40—+40.00 m: Coarse sandstone, coarsely bedded, partly rust coloured.

24.40—26.40 m: Sandstone, black (carbonaceous), fine grained shaley.

22.40—24.40 m: Sandstone, yellowish-white, coarse, generally without bedding.

21.60—22.40 m: Sandstone, dark, fine grained, bedded.

20.20—21.60 m: Sandstone, coarse, yellowish-white.

19.30—20.20 m: Conglomerate, rolled pebbles, cobbles and (up to head-size) boulders of quartzite, and phyllite, coloured dark by carbonaceous particles.

17.00—19.30 m: Sandstone, dark, finer and coarser grained with rolled pebbles of quartzite; partly coarsely bedded, partly finely shaley, much faulted.

0.00—17.00 m: Sandstone, yellowish-white, coarsely and poorly bedded, partly cross-bedded, streaked with pea-sized quartz pebbles.

A new dark bed begins immediately above the beach and rises northwards.

Abundant plant fossils were found loose below the dark bed at Station 415; it could not be determined from which bed they originated.

Station 460 m north.

The lowermost dark bed of the previous Station can here be measured to a thickness of 2.70 m.

Station 475 m north.

A pyrite concretion, the size of a head, was seen here in a fallen sandstone block. Plant fossils were found here in the same rock as at Station 415.

Station 520 m north.

The dark bed disappears at the top of the cliff, which is here lower and badly screed.

The Section South of the Stream.

The main features of the section south of the stream (viewed from the delta) are shown in pl. 3 fig. 1.

A basalt dyke ("B. H.") reaches an elevation of more than 300 m; it strikes approximately N—S and is surrounded on all sides by sandstone. Two smaller basalt dykes cut the surrounding sandstone in the following manner:

Dyke "B. I", north of the main dyke, strikes N. 84° W. Dyke "B. II", a little further south, strikes N. 50° W. It goes up through the pass + 225 m, and shortly after having passed the highest point of the pass, it is replaced by another dyke, "B. III"), which extends from the pass to Station 137 (the point of entry of the southern tributary into the main stream), its strike is therefore N. 75° E.

The following can be stated concerning the sediments in the southern section.

S. 1. Loose blocks of sandstone, yellowish white.

S. 2. Sandstone, yellowish-white, with brown clay pellets: is only seen as loose blocks. Contains pea-sized rolled pebbles, mainly of quartz, but with some kaolinized feldspar. Some parts are more fine-grained, darker, highly micaceous, with small fragments of coal or carbonized branches.

S. 3—4. Sandstone, yellowish-white, in situ. Either coarsely banked, or more finely bedded. Banks, several meters thick, are separated by fine-grained black sandstone, highly micaceous and coloured by finely divided carbonaceous matter, containing frequent carbonized branches or coal containing such branches.
There is a slight S—SE dip.

S. 4. is seen in situ from an altitude of + 80 m in the gulley to + 225 m (paulin) in the pass.

S. 5—6. Sandstone, coarse, in situ.

The Section Inland Along the Stream.

Lighter or darker coloured beds of sandstone, dipping east, as described above, are seen at intervals along the whole course of the stream.

At one place there is a conglomerate containing rolled pebbles of quartz and phyllite.

While the basalt dykes "B. H." and "B. I." do not extend north of the stream, this is cut by dyke "B. III" at Station 137 in such a way that the north bank of the southern tributary is formed by the dyke which, north of the stream, is enclosed in the sandstone, dipping west.

In a narrow gulley about 3 km from the coast, the sandstone changes to a fine-grained dark type. According to the bedding relations this must be the youngest deposit.

In the southern tributary (which enters the main stream at Station 137) there is yet another type of sandstone: almost exclusively fine-grained, and very finely shaley. It dips 30—40° SE and seems then to pass under the "normal" sandstone in the main stream. It was not, however, possible to examine the bedding relations more closely.

General Remarks.

According to its general appearance, alternating between very fine-grained, almost silty, sandstone, and coarse conglomerates, showing cross-bedding and ripple-marks, and enclosing carbonized leaves and branches, the whole sedimentary series is presumed to have been deposited close to the shore, under such topographic conditions that continuously changing sediments have resulted.

The basalt dykes must be younger; they everywhere cut the sediments, and no basalt pebbles are found in the conglomerates.

It is not possible to date the disturbance of the sediments; it is possibly contemporaneous with the formation of the dykes.

II. THE FOSSIL PLANTS

By Eske Koch

From the above description of the section it is apparent that plant fossils were found in the coastal section north of the stream at Station 415 (see page 5). They were found lying loose on the surface. The rock is a dark-grey, micaceous, silty shale such as is found at several horizons in the section.

The fossils are leaf impressions. Those found in the most fine-grained and dense rock varieties are rather well preserved, while others are too poorly preserved to be determined. A rather monotonous flora is indicated by the material examined. The following species have been found:

Platanus latiloba Newb.
Cycadophyte incertae sedis.

Some other indeterminable plant-remains were also found.

Platanus latiloba completely dominates at this locality, and it is the only species which it has been possible to identify without reservation.

Platanus latiloba Newb.

Pl. 1—2.

Newberry: (1898) The later extinct floras of N. Am., p. 105, pl. 1, No. 4.
Seward: (1926) Cretaceous Plant-bearing Rocks of Western Greenland, p. 125, pl. II, No. 109.
Synonym: Platanus Heerii Lesq. in Heer: Flora foss. grønl., p. 72, pl. VII, figs. 1 & 2, pl. VIII, figs. 1 & 2a, pl. IX, figs. 1—4.

For other synonyms see Seward (1926) and La Motte (1944).

Five fairly well preserved specimens, the margins of which are however missing, have been brought home. A number of fragments have also been found.

As far as can be seen from the venation and the preserved parts of the margin, the leaf has been entire and weakly to moderately trilobate. The characteristically decurrent margin is not satisfactorily preserved on any of the specimens found. One specimen, however,

shows secondary veins issuing from the midrib at a short distance below the point where it divides into three. This, together with a preserved part of the basal margin, seems to indicate that character. The midrib, which ascends from the petiole, divides into three almost equal primary veins on the lamina. The lateral primary veins are given off at an acute angle and are sub-opposite; they are straight or backward-curved. Sub-opposite or alternating secondary veins issue from the primaries at an acute angle, and are more or less forward-curved. Beginning from the origin of the lateral primary veins secondaries are given off towards the margin. Secondaries extending inwards to supply the inner sides of the lateral lobes are first given off at a longer distance from the origin. The extent to which these have developed varies among the specimens collected and is most likely related to the degree of lobation. The tertiary venation forms a more or less irregular, rectangular network. The tertiary veins generally originate approximately at right angles to the secondaries. The measurements are to some extent varying, breadth and length being approximately equal. One specimen is approximately 10 cm wide, two are somewhat larger, and two are smaller.

The leaves agree with HEER's description of Platanus Heerii Lesq., and only differ from LESQUEREUX's description in being more strongly lobed.

Similarly there is agreement with Platanus latiloba Newb. of which SEWARD describes specimens from Upernivik Næs, Angiarssuit[1]), and Atanikerdluk. In agreement with the great variation in leaf form among recent Planes, SEWARD makes this species very comprehensive, and both the leaves from Qeqertarssuaq and HEER's material from Upernivik Ø agree with this variation; both are distinctly trilobed, and almost entire leaves are included. The determination is established by the existence of the plane fruit demonstrated at pl. 1 fig. A.

Occurrence: The species was first found at Upernivik Næs, which was the only locality in Greenland until SEWARD, in 1921, also found it at Atanikerdluk Peninsula, and at Angiarssuit as well as at Upernivik Næs. It seems only to occur in the Atane Series. (Lower Upper Cretaceous?).

Outside Greenland Platanus latiloba is known from several localities in Dakota-, Tuscaloosa-, and Woodbine-formation of the Upper Cretaceous of U. S. A. Further it is known from the lower part of the Upper Cretaceous in Alaska and the Upper Cretaceous Dunvegan sandstone of British Columbia. It is also mentioned from the Eocene Raton-formation of New Mexico. But wheather there is specific identity or not is not sure.

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[1]) At Slibestensfjeldet.

Undetermined Cycadophyte.

A poorly preserved specimen has been found in the sandstone of the northern section. Upon the specimen some carbonaceous matter was preserved, but unfortunately it could not furnish any satisfactory cuticular preparation.

The specimen shows a fragment of a pinnate leaf. The 3 mm wide rachis bears long, narrow, closely placed pinnae, which are given off at about 45° and curve slightly forward. Pinnae are linear, terminally tapering a little towards apex that is nowhere preserved. The axis is bipinnate, the one row of pinnae is well represented by impressions with a number of carbonized cuticle fragments preserved. Of the other row only a few basal fragments of pinnae are present as the axis lies along one edge of the rock specimen. Pinnae are basally 2 mm wide, and the longest pinna fragment on the impression is 70 mm long; the attachment to the axis is nowhere visible, but at one place it seems as though the midrib is slightly depressed, suggesting that the pinnae may be somewhat recurrent. The results of mazaration of the carbonized matter were not satisfactory, the cell structures not being visible. Some slide representing the basal part of a pinna seems to show a double midrib; though in that case the midrib is much deformed, the one part of the double rib being very much thinner than the other. I would suggest that what here is seen is the double midrib of Pseudocycas Nath; but I cannot believe in the alternative solution that a crack owing to drying should be the reason why these two black strings are connected by an unbroken film of organic matter. I would suggest that the phenomena has its cause in the organic structure of the midrib of the pinna. The other slides are just as doubtful, so it cannot be proved whether this specimen is a Pseudocyas in the sense of NATHORST.

The specimen shows a distinct similarity to what is figured by SEWARD as Pseudocycas steenstrupiana (SEWARD 1926, pl. 9, fig. 64 & fig. 67). The similarity with fig. 64 is particularly striking. This specimen has also long narrow pinnae only slightly decreasing in breadth, slightly curved forward, and issuing at an angle of 45°. The relative dimensions also agree. The pinnae are also placed closely to each other, but they are not touching or partly covering each other as is the case with P. dicksoni and P. thomasi. To establish whether a specimen belongs to Cycadeoidales or to Cycadales, it is necessary to have good cuticle preparations. Thus it is only possible to place this specimen among the Cycadophytes though I must point out the similarity in outer morphology with Pseudocycas steenstrupiana as it is known from the Atane series of western Greenland.

Apart from Platanus latiloba and the Cycadophyte incertae sedis poorly preserved ferns, which I have not been able to determine with certainty, have been found. In this case there are, however, too many possibilities, for the greater part species which HEER has referred to Gleichenia (Gleichenites). Nevertheless it may be of interest to stratigraphical interpretation that Gleichenites species are so common at Upernivik Næs that SEWARD tends even to refer this locality to the Kome series. I would mention that this collection is the result of only a few days reconnaissance at Qeqertarssuaq island, and I feel sure that a more thorough collection might furnish better material.

Stratigraphical Remarks.

The stratigraphical evidence which can be derived from the finding of these two species is not conclusive, but is as follows:

Platanus latiloba has been found at Upernivik Næs, Lower Atanikerdluk, and Angiarssuit. Opinions differ concerning the age of the beds at Upernivik Næs. HEER refers them to the Atane Series, while SEWARD rather refers them to the Kome Series, partly on the basis of the abundant occurrence of Gleichenites which is dominant in the Kome Series, but rare in the Atane Series, and partly because Platanus latiloba has been found at Angiarssuit in what SEWARD assumed to be Kome beds. These beds are, however, younger, the locality being west of that fault near Angiarssuit which has been mentioned by WHITE & SCHUCHERT (1898). East of the fault are found indisputable Kome beds with Sciadopitytes Crameri (Pinus Crameri) and Taeniopteris, Gleichenia Zippei, etc. (see WHITE & SCHUCHERT (1898)) while the area west of the fault is downthrown; and so younger beds are brought down to the same elevation as the Kome Series east of the fault. The flora at WHITE & SCHUCHERTS' locality B that contains Platanus heerii (= P. latiloba), is stated to be related to Atane, and locality C is "not older than Atane flora". It is at locality C that SEWARD found Platanus latiloba[1]), which means in beds that are not older than the Atane Series.

As it has also been found in the Atane Series at Atanikerdluk, its presence at Upernivik Næs tends to indicate the relation of this occurrence to the Atane Series. In recognizing the floras listed from the Kome Series, it is obvious that angiosperms are extremely rare[2]), and that plane leaves have never been found in the Kome Series. To all appearances the angio-

[1]) SEWARD: (1926 pp. 128 & 162).

[2]) Or absent, ref. pag. 12.

sperms had not developed as far as this area at the time when the Kome beds were deposited. When the sediments of Qeqertarssuaq and Upernivik Næs were laid down, the plane had reached a dominant position represented by Platanus latiloba which is also found in indisputable Atane beds.

Cycadophytes of the type found at Qeqertarssuaq are known from Atanikerdluk and Upernivik Næs (Pseudocycas steenstrupi), but of course our undetermined specimen proves nothing. Its existence together with Platanus latiloba may establish the impression of resemblance with the flora of Upernivik Næs on the neighbour island, Upernivik Ø. The resemblance is also emphasized by the pronounced lithological similarity (reference is here made to Dr. ØDUM's description of the section).

The outstanding difference between the Kome Series and the Qeqertarssuaq beds is the existence of plane leaves in a dominating position in the latter, and that the plane is a species (P. latiloba) that has only been found in Greenland in Atane beds and younger beds. But it must be admitted that nothing can be proved by so few fossils, and a new collection will be necessary to establish these first impressions.

Finally I want to point out that SEWARD, on the basis of the presence of fossil angiosperms in the Kome flora, advocated the theory that the Tertiary floras on the northern hemisphere should have their origin in Greenland or adjacent parts of the Arctic. As it is rather doubt-some whether the occurrence at the Upernivik Ø belongs to the Kome Series, and as the majority of the fossil angiosperms, which according to SEWARD belongs to the Kome Series, has been found at this locality, his theory becomes rather weakened. The only remains of angiosperms which, as far as I know, have been found together with Kome fossils, is Populus primaeva Hr. from Pâtorfik on the northern coast of the Nûgssuaq Peninsula. From this place only one specimen is known containing such remains (figured in Heer, Kreideflora d. arkt. Zone 1874, pl. 29, fig. 6). On the northern coast of the Nûgssuaq Peninsula there is a considerable thickness of sediments with the Kome Series at the bottom. On top of this there are probably Atane beds, at any rate considerably younger sediments, as a sequence has been observed to be unconformably deposited on the Kome Series of Slibestensfjeldet somewhat more easterly. In consideration of the fact that the old collections often contain pieces that have been found lying loose on the surface, and as it is impossible from labels or somehow else to see what has been gathered loosely and what in situ, the piece with Populus primaeva Hr. may very well arise from the younger series, the more so as it is completely impossible lithologically to discern one series from the other. Furthermore the said type of leaf is not a very characteristic

one, and it will always be possible to find an equivalent to it among the fossils from the Atane Series.

From this it appears that the problem regarding the presence of angiosperms in the Kome flora is unsolved, and so far nothing definite can be stated until fresh collections have been gathered from the above-mentioned localities. And so far the theory of the presence of the oldest known angiosperms in West Greenland may be unsupported.

LITERATURE

HALLE, T. G. (1915): Some xerophytic leaf-structures in Mesozoic plants. Geol. Fören. i Stockholm Förhandl., Vol. 37, p. 493.

HEER, O. (1868): Flora fossils arctica, Zürich.

— (1874): Die Kreideflora der arctischen Zone, Kungl. Sv. Vetensk. Akad. Handl., Bd. 12, No. 6, Stockholm.

— (1883): Flora fossilis groenlandica, Zürich.

— (1922): Flora fossils groenlandica, plates in supplement to Medd. o. Grønland, Bd. 5.

HOLDEN, R. (1914): On the relation between Cycadites and Pseudocycas, New Phyt., Vol. 13, p. 334.

HOLLICK, A. (1930): The Upper Cretaceous floras of Alaska. U. S. Geol. Surv. Prof. Paper, 159.

KNOWLTON, F. H. (1919): Catalogue of the Mesozoic and Cenozoic plants of North America 1919—1937. U. S. Geol. Surv. Bull. 696.

KOCH, L. (1929): Stratigraphy of Greenland. Medd. om Grønland, Bd. 73.

LA MOTTE (1944): Supplement to the catalogue of Mesozoic and Cenozoic plants of North America 1919—1937. U. S. Geol. Surv. Bull. 924.

LESQUEREUX, L. (1874): Contribution to the fossil flora of the Western Territories, Part I: The Cretaceous Flora, Washington.

NATHORST, A. G. (1907): Paläobotanische Mitteilungen No. 1, Kungl. Sv. Vetensk. Acad. Handl. Bd. 42, No. 5, Stockholm.

NEWBERRY, J. S. (1898): The later extinct floras of North America. (A posthumous work by A. Hollick), U. S. Geol. Surv. Monogr. XXXV, Washington.

ROSENKTANTZ and others (1940): Medd. fra Dansk Geol. Forening Bd. 9, pp. 654—663.

SEWARD, A. C. (1926): Cretaceous plant-bearing rocks of Western Greenland. Phil. Trans. Roy. Soc., London, Ser. B, Vol. 215, pp. 57—175.

WHITE, D. & SCHUCHERT, CH. (1898): Cretaceous series of the west coast of Greenland. Bull. Geol. Soc. America Vol. 19.

Færdig fra trykkeriet den 14. marts 1955.

PLATES

Plate 1.

Platanus latiloba Newb.

A. Basal part of a leaf and a fruit (at "A"). 1:1. (KOCH fot.).

B. Basal part of leaf, slightly reduced. (HALKIER fot.).

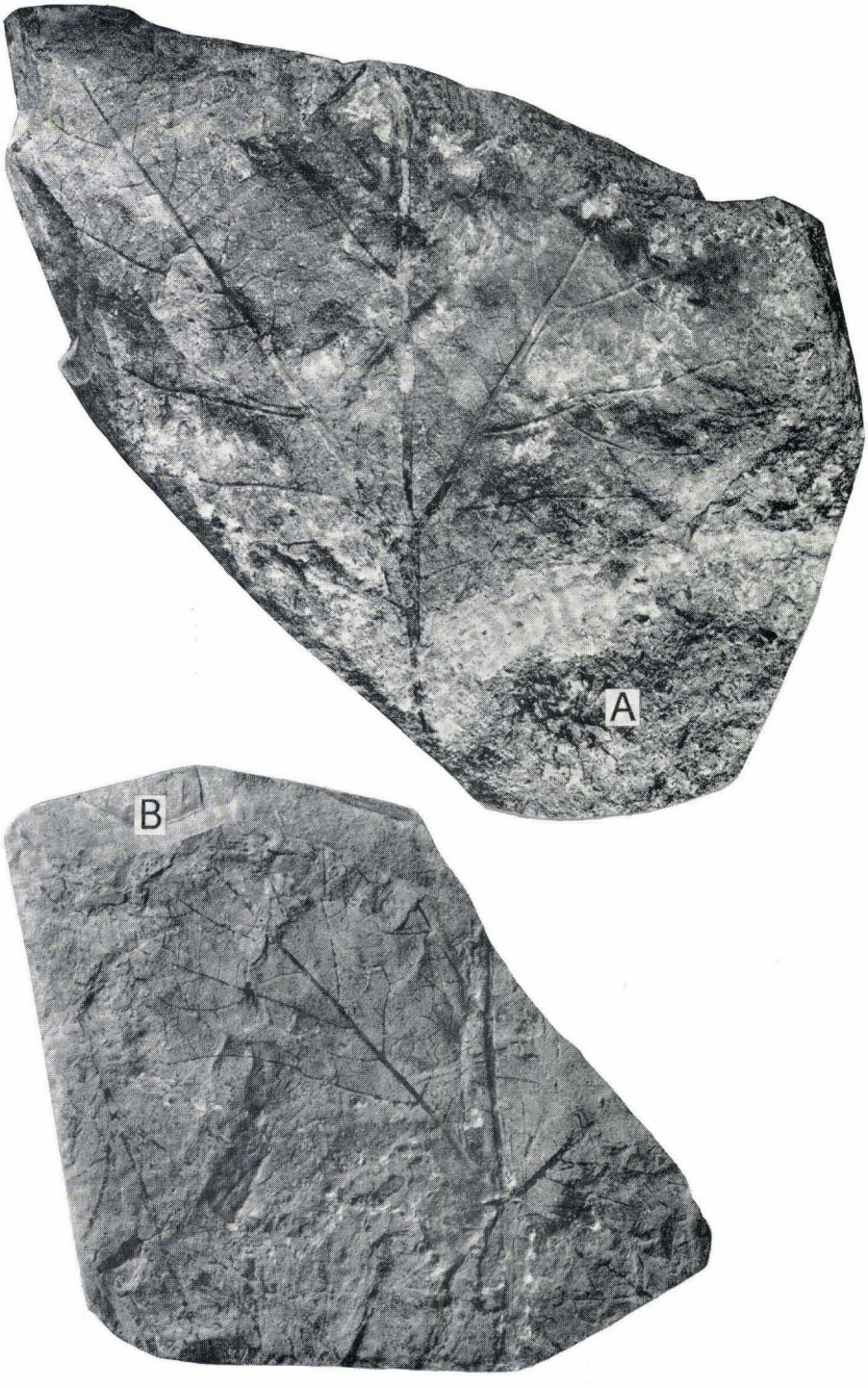
A
B

Plate 2.

Platanus latiloba Newb.

A. Nearly entire leaf, 1:1. B. Basal part with lateral lobe, 1:1.
(HALKIER fot.).

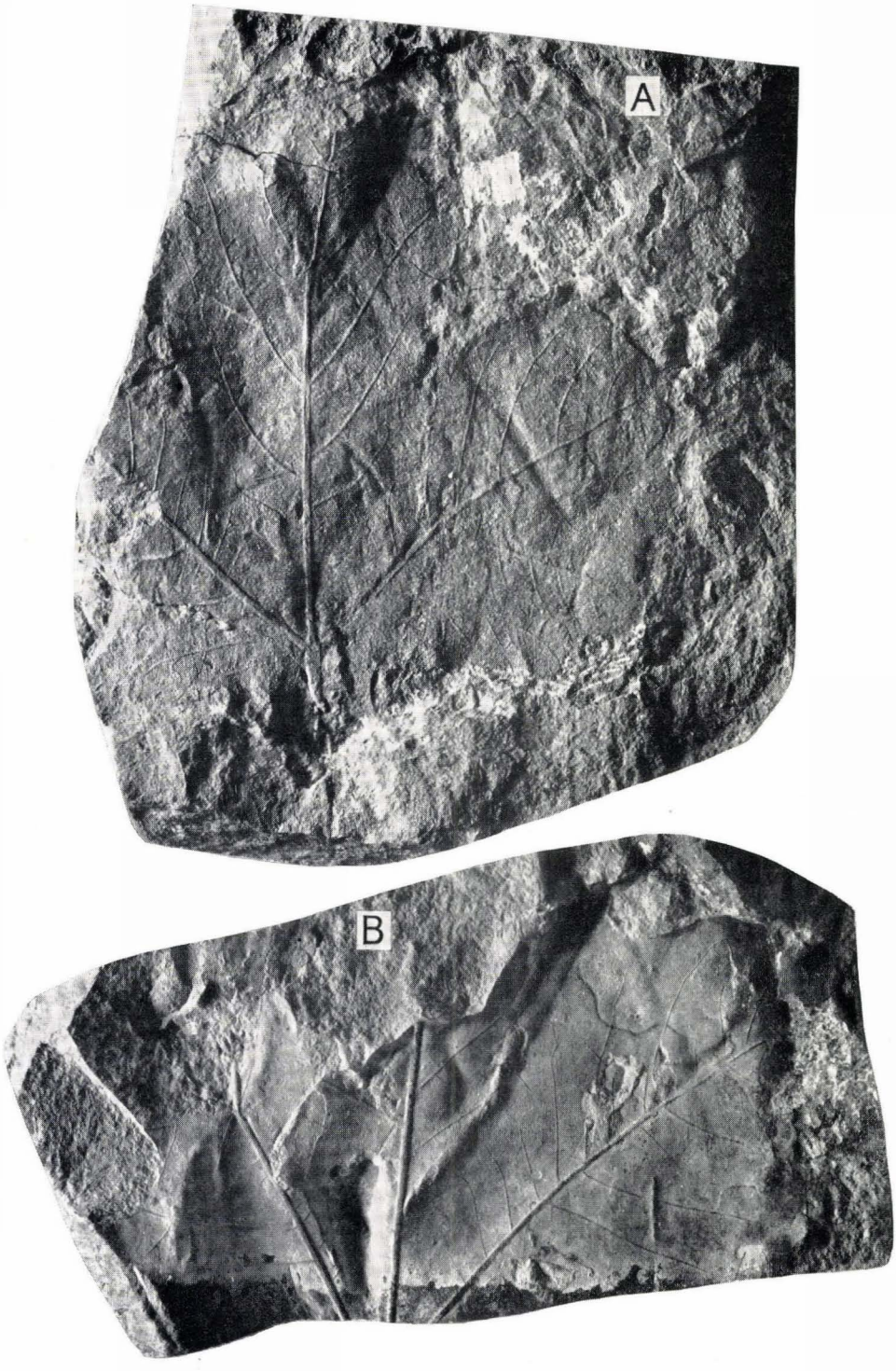
A
B

Plate 3.

Cretaceous sediments and Basalt dykes north of Naujât. Qeqertarssuaq, West Greenland.

Fig. 1: BH, BI, BII = Basalt dykes.
S1—S6 Sedimentary outcrops.

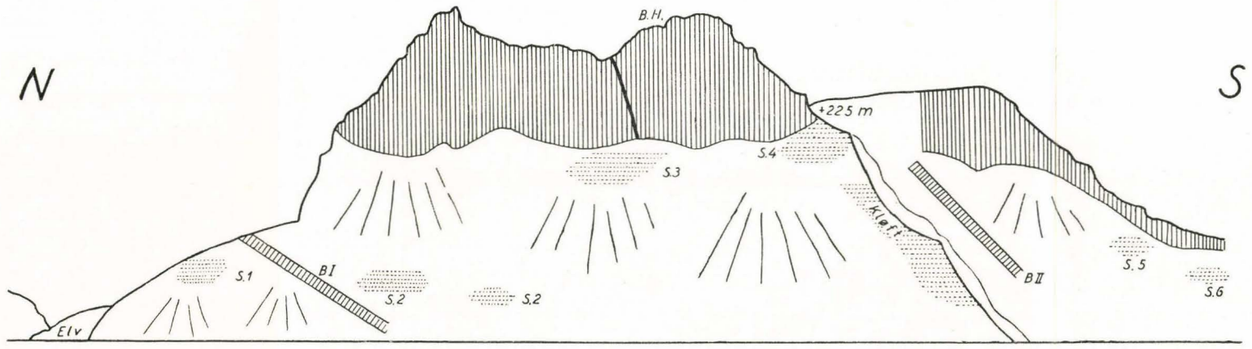
N
S
B.H.
+225 m
S.1
S.2
S.2
S.3
S.4
S.5
S.6
B I
B II
Klint
Elv

Fig. 1.

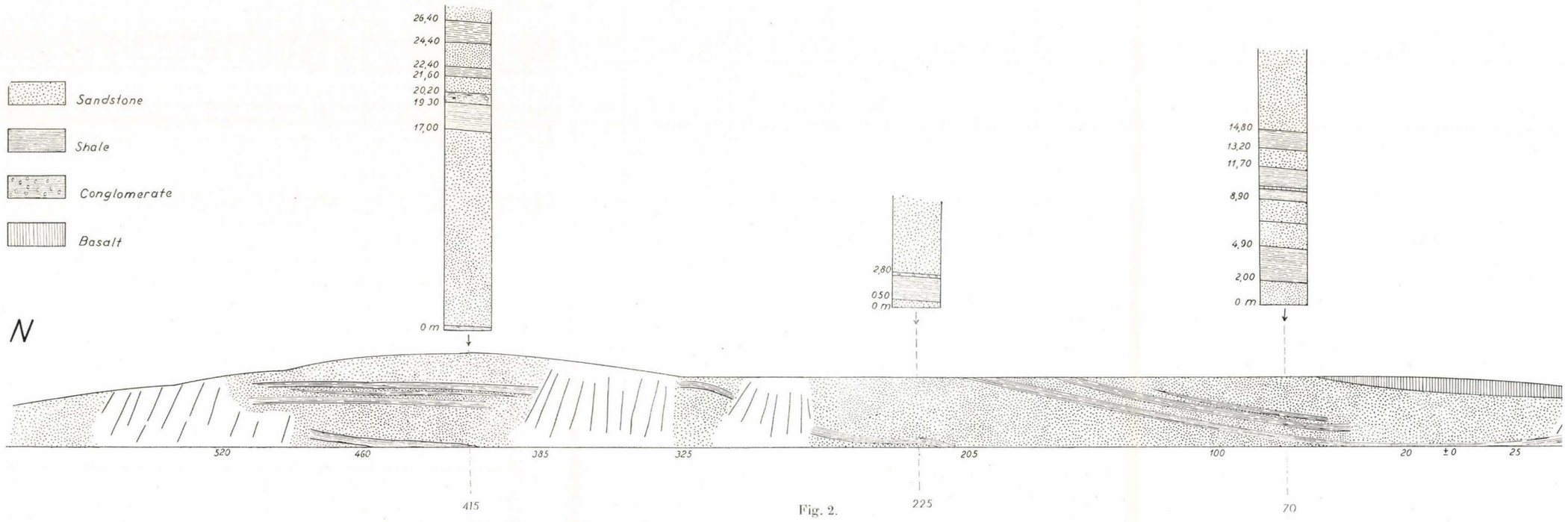
Sandstone
Shale
Conglomerate
Basalt
N
26,40
24,40
22,40
21,60
20,20
19,30
17,00
0 m
2,80
0,50
0 m
14,80
13,20
11,70
8,90
4,90
2,00
0 m
520
460
385
325
205
100
20
± 0
25
415
225
70

Fig. 2.