8. Notes on the Structure and Development of the Turfmoor Stormur in Gestrikland

by

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Staying for a fortnight in the month of July last summer in the neighbourhood of the town of Gefle, I got the opportunity of visiting the big turfmoor *Stormur*. Because of a draining which had lately been done there were to bee seen several fine profiles through the turf, which encouraged me to select some samples for an exact examination of the turf. On a second excursion to the moor in the month of September of the same year new samples were taken, and examinations were made of the present vegetation of the moor.

The proofs of the turf have been separated by washing and examined according to the method of Dr. GUNNAR ANDERSSON [1]. The diatoms are kindfully determined by Miss ASTRID CLEVE, Ph. C. For the rest I render my thanks to Dr. R. SERNANDER, who has assisted me with his advices and his rich experience.

The turfmoor is situated about 13 kilometres in the south of Gefle at a height of about twenty metres above the level of the sea. It is of a very irregular form. The bottom of the moor is formed by moraine, which is also the case with the hills which surround it in all directions. In all probability the water has always had its outlet at the same place situated in the southern part of the moor where the big drain now is dug. Because of the great sloping of the ground beyond the drain-sill, it is very difficult to imagine an occasional shutting up of the water.

Now I will pass to give a report on the present vegetation of the turfmoor, following a terminology mostly given by HULT [2] and SERNANDER [3].

The present vegetation of the turfmoor is mostly composed by *Cariceta amblystegiosa*. On certain places, where the moraine is rising,

[1] Geologiska Fören. Förhandlingar. Bd. 14, 1892 p. 165.

[2] HULT, Försök till en analytisk behandling af växtformationerna. Meddelanden af Soc. pr. Fauna & Flora fennica. Häft. 8, 1881.

— Blekinges vegetation. Ibidem. Häft. 12, 1885.

[3] SERNANDER, Studier öfver den gotländska vegetationens utvecklingshistoria. Inaugural-dissertation. Upsala 1894.

there is to be seen a typical *formation of Myrica Gale.* Sometimes this formation is about to change into a *formation of Rhamnus Frangula.* In order to give a sketch of these formations I communicate the following notes, made according to the method of R. HULT[1]. I will begin with a characteristic *Caricetum amblystegiosum* HULT from the central part of the moor. The **ground-vegetation** is almost always composed by *Amblystegium scorpioides* L. and *Amblystegium stellatum* (SCHREB.) but is generally not perfectly consistent. The **field-vegetation** of this formation exhibits such plants as *Carex panicea* L. (scattered); *Phragmites communis* TRIN. (rare) and *Carex Oederi* (EHRH.) HOFFM., *Rhynchospera alba* (L.) M. VAHL., *Oxycoccus palustris* PERS., and *Peucedanum palustre* (L.) MOENCH (scattered). In some parts of the moor the vegetation changes somewhat. Thus the *Carex panicea* L., especially in more marshy places often is substituted by plentiful *Carex chordorrhiza* EHRH., and scattered *Eriophorum vaginatum* L. while *Amblystegium intermedium* (LINDB.) often frames the ground-vegetation of such localities. On other places on the contrary there are instead of the above mentioned Carex-species, plenty of *Carex filiformis* L. mixed with *Carex acuta* L., *Ranunculus Flammula* L. and *Viola epipsila f. suecica* (FR.). In such localities Amblystegia are generally not to be found. Where the ground grows marshier we find formations of *Menyanthes trifoliata* L., and *Equisetum limosum* L. and at length where the marshiness is greatest, a formation consisting of such plants as *Juncus bufonius* L., *Juncus compressus* JACQ., *Sparganium minimum* FR., and *Utricularia intermedia* HAYNE.

In the characteristic formation of *Myrica Gale* L. which is predominant on the borders of the moor and which generally reaches about 10 metres beyond the *Abiegna hylocominosa* that everywhere surrounds the moor except at the issues of the brooks the same plants are found as in the *Carex panicea*-formation. Only the *Myrica Gale* L. itself is here to be regarded as a newcomer. In places, where the ground is more dry and the turf less thick, this *formation of Myrica Gale* gradually changes into the *formation of Rhamnus Frangula.* In this case the colony of plants can have following aspect: **Highest field vegetation:** *Myrica Gale* L. (plentiful); *Rhamnus Frangula* L., *Juniperus communis* L. (scattered); **the underwood:** *Rhamnus Frangula* L., *Betula odorata* BECHST., and *Alnus glutinosa* (L.) J. GÆRTN. (scattered). **The low-wood:** *Pinus silvestris* L. (scattered).

As to the surrounding *Pineta hylocominosa* the following notes may be left, made at a distance of 12,5 metres from the border of the moor. **The ground-vegetation:** *Hylocomium parietinum* (L.), *H. proliferum* (L.), *H. triquetrum* (L.), BR. EUR. (abundant); *Dicranum undulatum* EHRH. (scattered); *Linnea borealis* L., (rare). **Lowest field-vegetation:** *Vaccinium vitis idæa* L. (plentiful); *Myrtillus nigra* GILIB. (scattered); *Potentilla erecta*

[1] HULT, Försök till en analytisk behandling af växtformationerna. Meddelanden af Soc. pr. Fauna & Flora Fennica. Häft. 8, 1881.

(L.) DALLA-TORRE, *Luzula piloza* (L.) WILLD., *Veronica officinalis* L., *Fragaria vesca* L., *Succisa pratensis* MOENCH, *Hieracium sp.* (rare); **Middle field-vegetation:** *Myrtillus uliginosa* (L.) DREJ., *Pteris aquilina* L., *Juniperus communis* L. (scattered); *Picea Abies* (L.) TH. FR., *Sorbus Aucuparia* L., *Agrostis vulgaris* WITH. (rare). **Highest field-vegetation:** *Juniperus communis* L. (scattered); *Picea Abies* (L.) TH. FR., *Calamagrostis arundinacea* (L.) ROTH (rare). **Under-wood:** *Juniperus communis* L. (scattered); *Picea Abies* (L.) TH. FR., *Alnus glutinasa* (L.) J. GÆRTN. (rare). **Low-wood:** *Picea Abies* (L.) TH. FR. (scattered); *Pinus silvestris* L., *Alnus glutinosa* (L.) J. GÆRTN. (rare). **High-wood:** *Picea Abies* (L.) J. GÆRTN. (scattered); *Pinus silvestris* L., *Alnus incana* (L.) WILLD., *Betula odorata* BECHST. (rare).

Here and there this *Abiegna hylocominosa* gives place to a *Abiegna sphagnosa* with a **ground-vegetation** of abundant *Sphagna,* and plenty of *Calluna vulgaris* (L.) SALISB. in the **field-vegetation.**

At the issues of the brooks which deliver water to the moor, the vegetation obtains a somewhat different aspect, according to the changed state of draining. On such a spot I made the following note: **Ground-vegetation:** *Amblystegium stellatum* (SCHREB.), *Schistophyllum adianthoides* (L.) LA PYL., *Acrocladium cuspidatum* (L.), *Astrophyllum punctatum* (L.) (scattered). **Lower** and **middle field-vegetation:** *Succisa pratensis* MOENCH, *Circium palustre* (L.) SCOP. (scattered); *Geum rivale* L., *Mentha aquatica* L., *Comarum palustre* L., *Potentilla erecta* (L.) DALLA-TORRE, *Thalictrum simplex* L., *Galium boreale* L., *Carex ampullacea* GOOD., *C. flava* L., *C. panicea* L., *Menyanthes trifoliata* L., *Ranunculus repens* L., *Geranium silvaticum* L., *Picea Abies* (L.) TH. FR. (rare). **Highest field-vegetation:** *Myrica Gale* L. (scattered); *Picea Abies* (L.) TH. FR., *Pinus silvestris* L. (rare). **Under-wood:** *Salix cinerea* L. (plentiful); *Rhamnus Frangula* L., *Alnus glutinosa* (L.) J. GÆRTN. (rare).

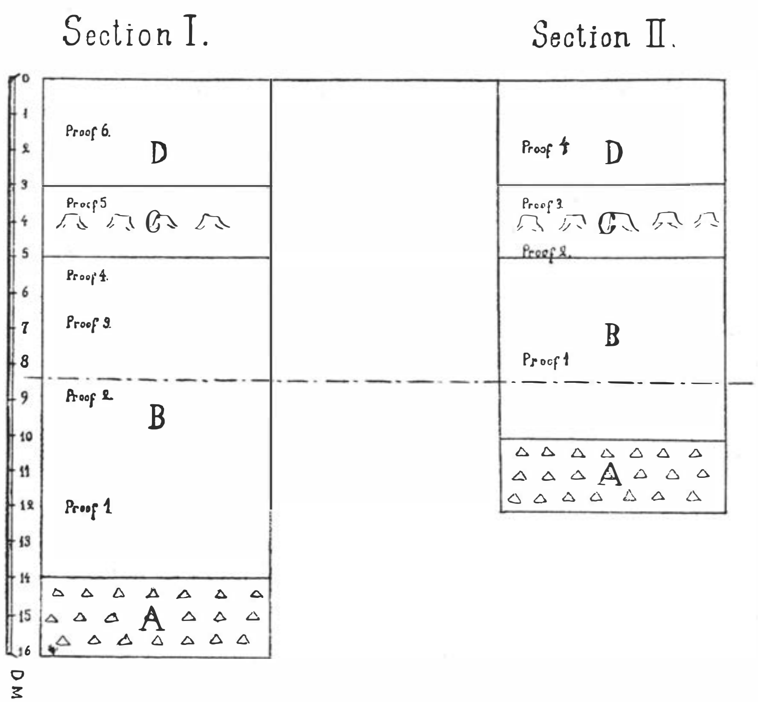
From what is said, it may easily be imagined, that the present vegetation of the moor is almost deprived of plants which characterize southern districts. Yet there are several such plants to be found in the neighbourhood, which prove that they are not strange to this part of the country. At Kubbo, about 4 kilometres in the south of Stormur, there are plants such as *Cladium Mariscus* (L.) R. BR., *Carex riparia* CURT., *Taxus baccata* L., *Liparis Loeselii* (L.) RICH., *Epipactis palustris* (L.) CR. On different places in the same neighbourhood we also find *Quercus Robur* L. and *Carex Pseudocyperus* L.

Having now given a survey of the vegetation of the moor, I pass to make a statement of its different strata (cf. Plate). The thickness of the turf varies very much; however it does not in general surpass 2 metres at any part of the moor. As the average we may note 1,2 metres. The section has following aspect:

A. Undermost: moraine, or moraine mingled with Joldia-marl.

B. Mire, passing farther up into Phragmitesturf; 0,1—1 metre.

C. A layer of stubs which is sometimes substituted by Carex-turf; generally about 0,2 metres in thickness.
D. Carex-turf; 0,2—0,3 metres.
As to the layer of stubs it is to be remarked, that it does not extend without interruption over the whole of the moor being substituted in marshy localities by Carex-turf. Generally the layer of stubs has a reach of about 125 metres from the border of the moor. At first very numerous near the border the stubs gradually decrease towards the middle of the



moor. At a distance of about 83 metres from the border the layer is composed only by rests of leaves and small branches. On a point, 62,5 metres from the border three stubs were measured. Of these the first had a diameter of 14 c.m., the second of 15 c.m. and the third of 20 c.m. The transition from the layer of stubs to the Carex-turf is very sudden. Though the draining of the moor has been lately done, the thickness of this Carex-turf is nevertheless very much reduced in consequence of the desiccation, which is probably also the cause of the strong mouldering of the same turf.

The samples of turf, which were taken, arise from two sections. The first (Section I on the plate) taken at a distance of 82 metres from the border, the second (Section II on the plate), 42 metres from the border.

These preliminary reports on the stratifying of the moor being made, I will pass to an enumerating of the fossils, which are found in the different proofs. As to the different levels, at which the proofs are taken, I refer to the plate adjoined. As to the diatoms (with which I begin) those who follow under I are freshwater-forms, those under II, forms of brackish-water with 0,2—0,5 $^0/_0$ salt, and those under III are typical Litorina-forms of water with about 0,8 $^0/_0$ salt.

Names	Section I						Section II				
	Proof 1	Proof 2	Proof 3	(Proof 4)	(Proof 5)	Proof 6	Proof 1	Proof 2	(Proof 3)	Proof 4	
I.											
Achnanthes lanceolata (Bréb.) Grun.	—	—	—			+	—	—		—	
Achnanthidium flexellum Bréb.	—	+	+			+	+	+		+	
Amphora ovalis Kütz.	+	+	—			—	—	—		—	
» » *var. affinis* Kütz.	—	—	+			—	+	—		+	
Campylodiscus Echineis Ehr.	—	—	—			—	+	—		—	A little fragment.
Cocconeis lineata Grun.	+	+	—			—	+[1]	—		—	
Cyclotella comta var. radiosa Grun.	+	+	+			+	+	+		—	
Cymbella amphicephala Nægeli.	—	—	+			—	+	—		—	
Cymbella angustata (W. Sm.)	+	+	+			+	+	+		+	
Cymbella æqualis W. Sm.	+	+	+			+	+	+		+	
Cymbella Cesatii (Rabh.) Grun.	+	+	+			—	—	—		—	
Cymbella cuspidata Kütz.	—	+	+			+	+	+		—	
Cymbella cistula var. maculata Kütz.	—	—	+			—	—	—		—	
Cymbella Ehrenbergii Kütz.	—	+	+			—	+	+		—	
Cymbella gastroides Kütz.	—	—	—			—	—	—		+	Fragments.
Cymbella Helvetica Kütz.	—	+	+			—	+	—		—	
Cymbella naviculiformis Auersv.	—	—	+			+	—	—		—	
Cymbella norvegica (Rabh.) Grun.	+	+	+			+	+	+		—	

[1] One individuum.

Names	Section I Proof 1	Proof 2	Proof 3	(Proof 4)	(Proof 5)	Proof 6	Section II Proof 1	Proof 2	(Proof 3)	Proof 4	
Cymbella parva W. SM.	—	+	—			—	+	+		—	
Diploneis ovalis var. oblongella NÆGELI.	—	—	—			+	—	—		—	
Encyonema lunatum W. SM.	+	+	—			+	—	—		—	
Encyonema ventricosum KÜTZ.	+	+	+			+	+	+		+	
Epithemia Argus (EHR.) KÜTZ.	—	+	—			—	—	—		—	
Epithemia gibba (EHR.) KÜTZ. . . . . , ...	+	+	+			—	+	—		—	
Epithemia Sorex KÜTZ.	—	+	+			—	—	—		—	
Epithemia turgida (EHR.) KÜTZ.	—	+	—			—	—	—		—	A fragment.
Epithemia Zebra (EHR.) KÜTZ.	—	+	+			—	+	—		—	
Eunotia Arcus EHR. . . .	+	+	+			+	+	+		+	
Eunotia Arcus var. uncinata EHR.	—	—	—			+	+	+		+	
Eunotia Camelus EHR. .	—	—	—			+	—	—		—	
Eunotia gracilis (EHR.) RABH. nec W. SM. . .	—	—	—			—	+	+		—	
Eunotia incisa GRÉZ. . .	—	—	+			—	—	—		—	
Eunotia incisa var. obtusiuscula GRÉZ.	—	—	—			—	—	—		+	
Eunotia lunaris (EHR.) GRUN.	—	—	—			+	—	—		—	
Eunotia major (W. SM.) RABH.	—	—	—			—	—	—		+	
Eunotia minor (KÜTZ.) RABH.	—	—	—			—	—	—		+	
Eunotia pectinalis GRUN.	—	+	—			+	—	—		—	
Eunotia pectinalis var. biconstricta GRUN.	—	+	+			+	—	+		—	
Eunotia prærupta GRUN.	—	—	—			+	—	+		—	
Eunotia prærupta var. bidens GRUN.	—	—	—			+	—	—		—	
Gomphonema acuminatum EHR.	—	+	+			+	+	—		—	

Names	Section I						Section II			
	Proof 1	Proof 2	Proof 3	(Proof 4)	(Proof 5)	Proof 6	Proof 1	Proof 2	(Proof 3)	Proof 4
Gomphonema acuminatum var. Brebissonii KÜTZ.	—	—	+			—	+	—		—
Gomphonema acuminatum var. coronata EHR. . . .	+	—	—			—	—	+		—
Gomphonema intricatum KÜTZ.	+	—	+			—	—	—		—
Gomphonema subtile EHR.	—	+	+			+	—	+		—
Navicula anglica RALFS.	—	+	+			+	+	—		—
Navicula bacilliformis GRUN.	+	+	+			+	+	+		—
Navicula cuspidata KÜTZ.	+	+	+			—	+	+		—
Navicula lanceolata KÜTZ.	—	—	+			—	—	—		—
Navicula limosa KÜTZ.	—	+	—			+	+	—		—
Navicula pseudobacillum GRUN.	+	—	—			—	—	—		—
Navicula Pupula KÜTZ.	+	+	+			+	+	+		—
Navicula radiosa KÜTZ.	+	+	+			+	+	+		+
Navicula tuscula (EHR.) GRUN.	—	+	—			—	—	—		—
Navicula vulpina GRUN.	+	+	+			+	+	+		+
Neidium affine (EHR.) . .	+	+	+			+	+	+		+
Neidium amphigamphus (EHR.)	—	+	—			—	+	+		—
Neidium Iridis (EHR.) . .	—	—	+			+	—	+		—
Nitzschia acuta GRUN. . .	+	+	+			—	+	+		+
Nitzschia Denticula GRUN.	+	+	+			—	+	+		—
Pinnularia divergentissima GRUN.	+	+	+			+	+	+		—
Pinnularia distinguenda CL. . . . . -	—	—	—			—	+	—		—
Pinnularia gracillina GRÉZ.	+	+	—			—	—	—		—
Pinnularia major KÜTZ.	—	+	—			+	+	+		+
Pinnularia mesolepta var. stauroneiformis EHR. .	+	+	+			+	+	+		+
Pinnularia microstauron EHR.	—	—	—			+	+	+		—
Pinnularia minor (=streptoraphe var. CL.*)* . . .	—	—	—			+	—	—		—

Names	Section I Proof 1	Proof 2	Proof 3	(Proof 4)	(Proof 5)	Proof 6	Section II Proof 1	Proof 2	(Proof 3)	Proof 4
Pinnularia nobilis (EHR.) KÜTZ.	—	—	—			—	+	—		—
Pinnularia stauroptera GRUN.	+	+	+			—	+	+		—
Pinnularia streptoraphe CL.	—	—	—			—	—	—		+
Pinnularia subcapitata GRÉZ.	—	+	+			—	+	—		—
Pinnularia undulata GRÉZ.	—	—	—			+	—	—		—
Pinnularia viridis KÜTZ.	—	—	—			+	+	—		+
Pinnularia viridis var. commutata GRUN. . . .	—	—	+			—	—	—		—
Pinnularia viridis var. rupestris KÜTZ..	—	—	—			+	—	—		—
Stauroneis anceps EHR. .	+	+	+			+	+	+		+
Stauroneis Phoenicenteron var. amphilepta EHR. .	+	+	+			+	+	+		—
Staurosira construens EHR.	+	+	—			—	—	—		—
Staurosira mutabilis (W. SM.) GRUN.	+	—	—			+	—	—		—
Surirella elegans (W. SM.) GRUN.	—	+	—			—	+	+		—
Surirella linearis var. constricta W. SM.	+	—	+			—	+	+		—
Synedra capitata EHR. .	+	+	—			—	—	—		—
Synedra Ulna (NITZSCH) KÜTZ.	—	+	—			—	+	—		—
Tabellaria fenestrata KÜTZ.	+	+	+			—	+	+		—
Tabellaria flocculosa (ROTH.) KÜTZ.	+	+	+			+	+	+		—
Van Heurckia rhomboides BRÉB.	—	—	+			+	+	—		—
II.										
Achnanthes brevipes COTZ.	—	+	—			—	—	—		—
Amphora commutata GRUN.	—	+	—			—	—	—		—

Names	Section I						Section II				
	Proof 1	Proof 2	Proof 3	(Proof 4)	(Proof 5)	Proof 6	Proof 1	Proof 2	(Proof 3)	Proof 4	
Campylodiscus Clypeus EHR.	—	+	—			—	—	—		—	A fragment.
Cocconeis scutellum EHR.	—	—	+			—	—	—		—	A fragment.
Grammathophora oceanica EHR.	—	+	—			—	—	—		—	
Mastogloia Braunii GRUN.	—	+	—			—	—	—		—	
Mastogloia Smithii THWAITES.	+	—	—			—	—	—		—	
Nitzschia scalaris (EHR.) W. SM.	+	+	—			—	—	—		—	
III.											
Rhabdonema arcuatum (AG.) KÜTZ..	—	+	—			—	—	—		—	One specimen.

Higher plants:

Section I.

Proof 1.

Nuphar luteum (L.) SM. seeds and intercellular hairs.
Salix repens L. A capsula.
Betula odorata BECHST. A whole catkin and free bracts.
Najas marina L. Fruits about 0,42 cm. long by 0,21 cm. broad.
Potamogeton sp. Seeds. Dr. G. TISELIUS in Stockholm who has kindfully examined these seeds is inclined to regard them as belonging to *Potamogeton colorata* HORNEM. or rather to *P. polygonifolia.* POURR. However he could not state anything certain about them.
Scirpus lacustris L. A fruit.
Pinus silvestris L. Leaves and pollengrains.
Picea Abies (L.) TH. FR. A leaf 1,2 cm. long by 0,12 cm. broad.
Amblystegium scorpioides (L.) Stalks with leaves.

Proof 2.

Nuphar luteum (L.) SM. Intercellular hairs.
Betula odorata BECHST. Seeds and bracts.
Alnus sp. A defect cone.
Najas marina (L.) Seeds. 0,32 cm. long by 0,19 cm. broad.
Potamogeton perfoliata L. Fruits.

Potamogeton sp. Fruits. As in proof 2, these seeds are considered by Dr. TISELIUS as possibly belonging to *P. coloratus* HORNEM. or *P. polygonifolius* POURR.
Phragmites communis. TRIN. Rhizomes and diaphragms.
Picea Abies (L.) TH. FR. Fragments of leaves.
Amblystegium scorpioides. (L.) Stalks with leaves.

Proof 3.

Nuphar luteum (L.) SM. Intercellular hairs.
Betula verrucosa EHRH. A bract.
Potamogeton perfoliata L. Fruits.
Pinus silvestris L. Two leaves, 0,63 c.m. long and pollengrains.
Picea Abies (L.) TH. FR. A seed and pollengrains.
Amblystegium scorpioides (L.) Stalks with leaves.

Proof 4.

Scheuzeria palustris L. A seed.
Carex riparia CURT. Numerous vesicles and seeds.
Pinus silvestris L. A seed and pollengrains.
(Diatoms are not found.)

Proof 5.

Pedicularis palustris L. Numerous seeds.
Peucedanum palustre (L.) MOENCH. Two halves of fruits.
Andromeda polifolia L. Leaves and a fruit.
Betula verrucosa EHRH. Seeds and bracts.
Alnus incana (L.) WILLD. Seeds.
Myrica Gale L. Leaves, seeds, and fruits.
Carex riparia CURT. Vesicles and seeds.
» *filiformis* L. Vesicles and seeds.
Pinus silvestris L. Leaves, seeds, and pollengrains.
Picea Abies (L.) TH. FR. Leaves, seeds, and pollengrains.
(Diatoms are not found.)

Proof 6.

Carex riparia CURT. Vesicles and seeds, but not so numerous as in the former proofs.
Myrica Gale L. Seeds.
Amblystegium scorpioides L. Stalks with leaves.

Section II.

Proof 1.

Nuphar luteum (L.) SM. Intercellular hairs.

Potamogeton pusilla L. Fruits, determined with reservation by Dr. G. TISELIUS.
Amblystegium scorpioides (L.) Stalks with leaves.

Proof 2.

Nuphar luteum (L.) SM. Intercellular hairs.
Myrica Gale L. A fruit.
Scheuzeria palustris L. Fruit-valves.
Carex riparia CURT. Vesicles and seeds.
» *filiformis* (L.) Vesicles and seeds.
Phragmites communis TRIN. Rhizomes and diaphragms.
Amblystegium scorpioides (L.) Stalks with leaves.

Proof 3.

Rhamnus Frangula L. A fragment of a seed.
Corylus avellana L. Nuts.
Betula verrucosa EHRH. Leaves, seeds and bracts.
Alnus glutinosa (L.) J. GÆRTN. Seeds and bracts of cones.
Myrica Gale L. Most numerous rests of leaves, buds, fruits, seeds, male and female catkins.
Carex riparia CURT. Vesicles and seeds.
Pinus silvestris L. Leaves from 2,4 cm. to 3,5 cm. long, complete cones, seeds, and wings of seeds.
Picea Abies (L.) TH. FR. Leaves from 1 cm. long and 0,12 cm. broad upwards to 1,27 cm. long and 0,13 cm. broad.
(Diatoms are not found.)

Proof 4.

Nymphea candida PRESL. A seed, 0,39 cm. long by 0,21 cm. broad.
Viola epipsila f. suecica LEDEB. Seeds.
Empetrum nigrum L. Seeds.
Betula odorata BECHST. Seeds and bracts.
Myrica Gale L. seeds, fruits, and buds.
Pinus silvestris L. Seeds.
Amblystegium scorpioides (L.) Stalks with leaves.
» *trifarium* (W. M.). DE N. Stalks with leaves.

Names	Section I						Section II				The present vegetation
	Proof 1	Proof 2	Proof 3	Proof 4	Proof 5	Proof 6	Proof 1	Proof 2	Proof 3	Proof 4	
Pedicularis palustris L.	—	—	—	—	+	—	—	—	—	—	+
Rhamnus Frangula L.	—	—	—	—	—	—	—	—	+	—	+
Peucedanum palustre (L.) MOENCH.	—	—	—	—	+	—	—	—	—	—	+
Nymphæa candida PRESL.	—	—	—	—	—	—	—	—	—	+	—
Nuphar luteum (L.) SM.	+	+	+	—	—	—	+	+	—	—	—
Viola epipsila f. suecica (FR.)	—	—	—	—	—	—	—	—	—	+	+
Rubus chamæmorus L.	—	—	—	—	—	—	—	—	—	+	—
Andromeda polifolia L.	—	—	—	—	+	—	—	—	—	—	—
Empetrum nigrum L.	—	—	—	—	—	—	—	—	—	+	—
Corylus Avellana L.	—	—	—	—	—	—	—	—	+	—	—
Salix repens L.	+	—	—	—	—	—	—	—	—	—	—
Betula verrucosa EHRH.	—	—	+	—	+	—	—	—	+	—	+
Betula odocata BECHST.	+	+	—	—	—	—	—	—	—	+	+
Alnus glutinosa (L.) J. GÆRTN.	—	—	—	—	—	—	—	—	+	—	+
Alnus incana (L.) WILLD.	—	—	—	—	+	—	—	—	—	—	+
Myrica Gale L.	—	—	—	—	+	+	—	+	+	+	+
Najas marina L.	+	+	—	—	—	—	—	—	—	—	—
Scheuzeria palustris L.	—	—	—	+	—	—	—	+	—	—	—
Potamogeton polygonifolia POURR.?	+	+	—	—	—	—	—	—	—	—	—
Potamogeton perfoliata L.	—	+	+	—	—	—	—	—	—	—	—
Potamogeton pusilla L.?	—	—	—	—	—	—	+	—	—	—	—
Scirpus lacustris L.	+	—	—	—	—	—	—	—	—	—	—
Carex riparia CURT.	—	—	—	+	+	+	—	+	+	—	—
Carex filiformis L.	—	—	—	—	+	—	—	+	—	—	+
Phragmites communis TRIN.	—	+	—	—	—	—	—	+	—	—	+
Pinus silvestris L.	+	—	+	+	+	—	—	—	+	+	+
Picea Abies (L.) TH. FR.	+	+	+	—	+	—	—	—	+	—	+
Amblystegium scorpioides L.	+	+	+	—	—	+	+	+	—	+	+
Amblystegium trifarium (W. M.) DE. N.	—	—	—	—	—	—	—	—	—	+	—

By means of the previous tables it is easy to give an account of the history of the turfmoor from its first heaving over the »Litorina-sea» to the present time. The moor lying at an altitude of about 20 metres above the sea-level, it is probable that the strata of which it is formed began to be deposited only at a comparatively late stage of the »Litorina-heaving». At that period the moor probably formed a deep bay, which was connected with the sea by a narrow sound in its souther part. A proof of this assertion are the species of diatoms of brackish water, which were found in Section I, proofs 1 and 2. These species who require a saltness of 0,2—0,5 % of the water have all an aspect which points at their having lived on the spot. The single specimen of *Rhabdomena arcuatum* (AG.) KÜTZ. which was found in proof 2, Section I and which requires a saltness of about 0,8 % has on the contrary probably been brought to the moor from another place. The occurrence of *Najas marina* L. may also be considered as a reason for the brackishness of the water at the very outset of the stratifying of the moor. In Scandinavia this plant is only found in brackish or salt water except in two localities. The fact that no marine clay is to be found, may be considered as proof *for* rather than *against* this assertion, which follows of a comparision with some bays on the present shore, showing conditions which seem to have been very analogous with those of the turfmoor. The vegetation in these bays is very conformable with the vegetation, which has been found as fossils in the lower parts of the moor, and the mud is almost always deposited directly on moraine.

In proof 1 Section I there are found two forms of brackish-water and in proof 2 six forms, a very remarkable circumstance, which probably only depends on the diatomaceous flora being more rich in proof 2 than in proof 1.

By degres the forms of brackish water disappear upward. In proof 3 there was only found a single specimen of *Cocconeis scutellum* EHR., which is a diatom of brackish water, and this was moreover only a small fragment which has probably not lived in this place. In Section II, proof 1 there is no brackisk water diatom found. From this we are to conclude that the bay has been perfectly shut up from the sea at a period of time when the layers were formed between eight and nine metres under the surface of the moor. At the same time *Najas marina* L. seems to disappear.

Thus beeing shut up the bay has turned a lake and the layers which now follow are composed by a typical lacustrine mud.

Now the basin of freshwater gradually fills up. This process having arrived at a certain point, the *Phragmites-formation* occupies the basin. Later on this *Phragmites-formation* gives place to a *Carex-riparia-formation* which in its turn changes into a *Myrica-formation*. The last two changes seem to have taken place in a relatively short time which makes one to suppose that they are caused by the entering of a dryer climate at a period of time correspondant with the *subboreal period* of BLYTT.

Dr. SERNANDER in his Inaugural-dissertation[1] has shown that the *Phragmites-formations* at the mires of Gotland change into *Myrica-formations*, passing at first through the formation of *Carex stricta* GOOD. and

[1] R. SERNANDER: Studier öfver den gotländska vegetationens utvecklingshistoria. Inaugural-dissertation. Upsala 1894.

subsequently that of *Carex panicea* L. The formation which in the turf is distinguished by the most numerous seeds and vesicles of *Carex-riparia* CURT. and *Carex filiformis* L., ought to be analogical to the above mentioned *Carex-stricta-formation*. The formation of *Carex panicea* L. on the contrary seems not to have existed, and the formation of *Myrica Gale* L. immediately succeeds to the formation of *Carex riparia* CURT. a fact that also points at the entering of a dryer climate.

As to the formation of *Myrica Gale* L. it is characterized by a turf which is almost exclusively composed by rests of *Myrica Gale* L. In this turf there are also found rests though very spare of some other plants e. g. *Pedicularis palustris* L., *Peucedanum palustre* (L.) MOENCH. and *Andromeda polifolia* L. which plants often are told to be characteristic of the formation of *Carex panicea* L.

After the turf of *Myrica Gale* L. there follows a turf with numerous rests of *Carex riparia* CURT. and *Carex filiformis* L. a circumstance which makes it probable that the moor has grown swampy again. But before this the formation of *Myrica Gale* L. seems to have reached a point of development probably identical with the first *Rhamnus Frangula-formation* which has its correspondent in the present vegetation above mentioned.

The cause of the marshiness is probably to be sought in the reentering of a wet climate. And according to this the period during which the turf above the layer of stubs has been deposited, ought to be identical with the *subatlantic period* of BLYTT.

The transition between the lower turf of *Myrica Gale* L. and the upper of Carex is very distinctly marked. The formation which is represented by the turf of Carex, was probably to some part a *Carex-panicea-formation*, the rests of *Carex riparia* CURT. and *C. filiformis* L. being most spare in the upper parts.

Referring to the previous tables we may remark, that rests of *Myrica Gale* L. are still found in the middle parts of the Carex-turf. However these rests are so few that it is to be questioned whether *Myrica Gale* L. has grown on the spot or not.

The fact that seeds of *Nymphea candida* PRESL. are found tells very much in favour of our theory as to the marshiness of the moor. This find, however, does not necessarily prove that the whole moor has been drenched, as *Nymphea candida* PRESL. often grows on such localities as are only sometimes completely overflowed.

Among other plants, which are characteristic to this time we have also to note *Viola epipsila f. suecica* (FR.), *Rubus Chamæmorus* L. and *Empetrum nigrum* L.

However it is clear that the development of the vegetation above said is not to be applied to every part of the moor.

At central points the desiccation during the *subboreal period* has never gone so far that a formation of *Myrica Gale* L. has been able to take place, but it has ended in a formation of *Carex riparia* CURT., and

C. filiformis L., while the *subatlantic period* is marked by a returning to the formation of *Phragmites communis* TRIN.

In such localities on the contrary where at present the *formations of Myrica Gale* L. or of *Rhamnus Frangula* L. are predominant, the development of the vegetation has passed on in another way. As it was mentioned in the beginning of this essay such localities are to be found not only at the borders of the moor, but appear also as islands, at central parts where the underlaying moraine is heaving itself to some extent. We may say that this is the case in general at every place where the thickness of the turf does not surpass 7 decimetres.

Here the lower parts of the atlantic layers consist of a *Phragmites-turf* which in its upper parts changes into a *Carex-turf*.

The layer of stubs which in such localities is thicker than that of the sections above given has there probably been formed by *Pineta*.

During the *subatlantic period* a return has taken place partly to the formation of *Myrica Gale* L. and partly to that of *Carex panicea* L.

At present the former has returned to the *formation of Rhamnus Frangula,* the latter to that of *Myrica Gale*.

As to the state of climate of which these layers bear witness, I will at first shortly remind of the state of humidity during the different periods at which the layers have been deposited.

Concerning the *atlantic period* nothing can be decided with full certainty. It is in consistence with the natural development of an open basin of fresh-water that it fills up by and by. As is above mentioned, the somewhat hasty change from the deposits of mud to the *Phragmites-turf* may possibly be explicated thus, that a less humid climate has succeeded to a more humid. That is as much to say that the *subatlantic period* has been replaced by the *subboreal period,* an explication which is confirmed by analogous observations from several other parts of Scandinavia.

It is perfectly clear on the contrary that the change of the subboreal layer of stubs to the subatlantic turf of Carex is owing to the climate turning wet. Otherwise it would be difficult to explain how it has been possible that the very typical *Myrica Gale-formation* has yielded to and been replaced by a *formation of Carex riparia* which oughts to be previous tho the *formation of Myrica Gale,* instead of continuing a development, which is apparently a rule with such like formations.

Another thing which also points at the climate having been more humid during the *subatlantic period* is the diatomaceous flora which at that period is relatively rich but which during the *subboreal period* is very scanty or has almost disappeared.

Another explication which however here as well as in several other cases would be very remote and improbable is that the issue of the moor should have been shut up in any way at a time when the subatlantic layers were deposited.

At last with regard to the climate in general, I will at first dwell upon the *atlantic period*. On account of the fossils which were found in layers of this time I think it is to be inferred that the warmth then was the same as at present. Among the plants which are found here as fossils, there is no one but *Najas marina* L. which as a rule is not found in the vegetation of to day. The fact that *Najas marina* L. is not to be found at similar localities in the neighbourhood is probably not to be explained by some difference of climate but rather by a general dying out of this plant ever since the *Litorina-time*.

By help of the finds of *Potamogeton polygonifolia* POURR. or *P. colorata* HORNEM. several conclusions with respect to the climate during the *atlantic period* might be made proving it to have been more insular during this time, but as the determinations of the fossils referring to this plant are not decided I will omit them.

At the end of the *atlantic period* a positive improvement of the climate seems to have entered. During this period the temperature seems, in a not inconsiderable degree, to have been more favorable than it is at present. This we are entitled to conclude because of the numerous rests of *Corylus Avellana* L. which are found at some parts of the moor, this plant decidedly belonging to southern districts. At present *Corylus Avellana* L. grows only on a single spot in the neighbourhood.

Another circumstance, which also enables us to assume a warm climate to have existed is the predominating of *Betula verrucosa* EHRH. in the leaf-wood, where *Betula odorata* BECHST. was formerly prevailing. A plant which also proves such a climate to have been during this period is *Carex riparia* CURT. This plant is not at all to be found in the present vegetation of the moor. Yet it grows at Kubbo which place is situated about 3 kilometres in the south of Stormur and which may also be indicated as the most northern habitat of the plant. At Kubbo, however, *Carex riparia* CURT. is only growing here and there while on the contrary in the upper and lower parts of the layer of stubs it seems to have formed a coherent formation.

During the *subatlantic period* the climate seems to have changed for the worse a fact which is mentioned before first by SERNANDER[1]. *Corylus Avellana* L. is dying out already in the beginning of this time and *Betula odorata* BECHST. occupies a predominant place in the leaf-wood.

Carex riparia CURT. decreases gradually upward though it still seems to have formed a coherent formation in the middle part of this turf.

Among other plants which also seem to have entered by reason of a colder climate we may mention such as *Nymphea candida* PRESL., *Viola epipsila f. suecica* (FR.), *Rubus Chamæmorus* L., *Empetrum nigrum* L., and *Amblystegium trifarium* (W. M.) DE. N. All these plants have a predominantly northern extention. The observations hitherto made prove

[1] RUTGER SERNANDER: Om s. k. glaciala relikter. Bot. Notiser, Lund 1894.

—: Om några arkeologiska torfmossefynd. Antiqvarisk tidskrift för Sverige, Del 16 N:o 2. 1895.

that *Nymphea candida* PRESL., *Rubus Chamæmorus* L., and *Amblystegium trifarium* (W. M.) DE. N. not are to be found at least in the present vegetation.

Through these examinations I think I have proved that the turf-moor of Stormur is constructed exactly in accordance with the type of moors assumed by SERNANDER [1] whose period of development is coincident with the time between the later part of the *Litorina-heaving* and the present day.

Furthermore I have tried to show that, in case changes of climate have not led the development in another direction the moor has been formed in a way typical for a basin of fresh-water which is being filled up and which changes into a *moor of Amblystegium*.

[1] RUTGER SERNANDER: Die Einwanderung der Fichte in Skandinavien. Englers Botanische Jahrbüchern Bd. 15, Heft. I. 1892.