FURTHER CONTRIBUTIONS TO THE MIDDLE DEVONIAN FLORA OF WESTERN NORWAY

BY

OVE ARBO HØEG

In 1931 I published a report on some new collections of plant fossils from the Middle Devonian of Nordfjord on the West Coast of Norway. Last summer (1934) I again made an excursion to these localities, accompanied and assisted by my wife. We went there rather late in summer, in the middle of August, hoping that the snowfields and glaciers would then be reduced nearly to their minimum. Probably this held good; but on the other hand the relatively dry part of the season had passed, and during most of the stay we had cold weather with pouring rain and sleet and sometimes fog, which made work somewhat difficult.

The bad weather did not permit us to visit new localities, and the work had to be confined to the best of the places where I had been before, the Devonskardet and the northern side of the Gjegnalund Glacier. I obtained some good specimens of plants known before from this flora, and also a few new forms, which will be described below. Of *Pseudosporochnus*, *Barrandeina*, *Psygmophyllum*, and *Brøggeria* no specimen was found, of *Hyenia* only few but interesting specimens.

The expences of the excursion were defrayed by a grant from the foundation "Fridtjof Nansens Fond". Further, the expedition was very much facilitated through the kindness of Mr Adolf Hoel, leader of the "Norges Svalbard- og Ishavs-undersøkelser", who lent me the necessary sleeping-bags.

Dawsonites Ellenae n. sp.

Plates I and II.

The material is confined to a single slab (PA 1083), 65 cm long, 25 cm broad, weight nearly 26 kg. It is part of a huge boulder, 3—4 m long, which was just coming out of the melting snow; the lower part of the boulder was not yet free, the snow round it being so deep that it was not likely to disappear in the course of the remaining part of the summer. The flat, vertical side of this boulder, reaching about a meter out of the snowfield, was strewn with plant fragments, most of them, if not all, belonging to one and the same species, as far as it could be determined on the spot. All efforts to split the boulder by means of chisels and hammers were in vain, and it was necessary to fetch equipment for blasting; by means of rock-powder a very good slab was obtained. The rest of the boulder had to be left on the spot, but the slab which was brought home contained by far the best plant impressions; those on the remaining part of the boulder chiefly consisted of innumerable small fragments exhibiting, as far as could be ascertained under the unfavourable conditions, no morphological features not found on this slab.

The preservation is not bad, and the external morphology can be studied fairly well; but there is very little left of organic matter, and no cuticle preparations are possible; this is the more deplorable in a case like this, because we have to deal with what is supposed to be sporangia.

The fossil remains comprise both sterile and fertile parts; it is very probable that they represent portions of one and the same plant, although the definite proof in the form of organic connection is lacking.

The fertile shoots. — The best specimen is the one shown on Pl. I fig. 1, with details enlarged on Pl. II figs 1—2. It is the upper part of a stalk, nearly 6 cm long and 1 mm broad, nearly straight and only very slightly zigzag according to the racemose ramification. On the left hand side there are three short branches bearing clusters of round bodies, probably sporangia. The branches are dichotomously divided; at least in some cases this forking takes place repeatedly. They terminate in flat or flattened bodies, more or less reniform, measuring about 1,8—2,2 × 1—1,6 mm; they seem to have their longest extension transversally to the stalks. In some cases they are apparently lateral, but this may only be due to pressure or deformation

during the fossilization. — These clusters are all on one side of the main axis. On the opposite side (to the right) and straight between them, there are other branches, which, however, are very short: The lowest one appears on the photographs (Pl. II fig. 1) as a little thorn; it could, however, be traced for some millimeters further into the matrix, and certainly it represents the base of a branch which has been broken or destroyed during the fossilization; whether it has borne sporangia or not could not be ascertained, but at least the part preserved was not divided. The next one has a peculiar shape, being very similar to a sporangium, nearly sessile, measuring $1{,}2 \times 2{,}4$ mm (Pl. II fig. 2); its outlines are sharply defined, but it is certainly only the base of a broken branch. — The very tip seems to be formed by an immature fertile region, slightly pendulous.

It cannot be decided with full certainty whether the apparently unilateral arrangement of the sporangia in this specimen corresponds to the original conditions or not. But there is another specimen in which the arrangement is spiral (or possibly distichous); on Pl. I fig. 1 it is seen to the right of the stalk just described, and a part of it is shown enlarged on Pl. II fig. 3. On the right-hand side of the axis there is a short branch with a juvenile cluster of sporangia; further up there is another branch to the left, also bearing sporangia, and at the base one can just see the top of a third cluster; the connection of the latter with the main axis is not directly observable, because a piece of the stone has been split off, but its position and shape can hardly be interpreted in more than one way. The specimen is also noteworthy on account of its well developed spines.

The real nature of these flat, rounded bodies is not definitely proved. They are talked of here as sporangia, and probably there is no reason to doubt that this is right. But spores have not been found and cannot be expected, the plant being preserved only as impressions with a film of rusty matter, very distinctly outlined, but scarcely with any organic matter left (only in the main axis there are remains of the tissue). Certainly the characteristic shape and constant size of these bodies, and their position, are too suggestive of organs of reproduction to render any other interpretation probable. But the possibility should at least be kept in mind.

The sterile parts. — The most complete specimens, as the one shown on Pl. I fig. 2, are branch-systems with axes of the same diameter and form as in the fertile shoots; but the lateral branches

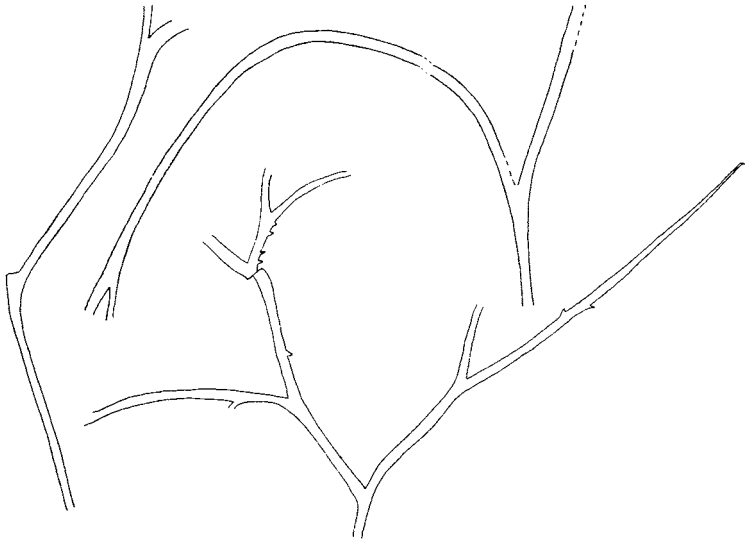

Fig. 1. Diagrammatic drawings of branches occurring together with *Dawsonites Ellenae* (PA 1083). — Nat. size.

are more elongated and have no sporangia. They divide repeatedly, usually with simple dichotomy at about right angle; but there are transitions to pseudo-monopodial branching, and the main axes are nearly straight. The ultimate tips are circinately recurved.

Most of the sterile branch-systems of this type are naked. One of the few instances of thorns is illustrated in Pl. I fig. 2 and Pl. II fig. 4: The first lateral branch from below is strongly recurved, and on the concave side it has several short processes; similar ones, but still shorter, are seen on other branches of the same specimen.

There are also several other fragments of axes of the same size and mode of branching, but as they bear neither sporangia nor ultimate ramifications, it cannot be said whether they belong to fertile or sterile branch-systems, a fact giving support to the idea that all fragments belong to one and the same species. The specimen seen on Pl. I fig. 7 and Pl. II fig. 5 is interesting on account of its long spines; in the upper part of the branch to the right is also seen a dot representing the base or scar left by a lost spine.

The specific identity of all these fragments has not been proved by the only indisputable evidence, — the organic connection between

the various types. It is, however, highly probable that the sporangia and the characteristic ultimate branches belong together. The fact that they occur together on the same slab in the most intimate intermixture is very suggestive, but it is of course no strong argument. But they agree in all details, in size and mode of ramification, and in the spines which occur on all kinds of axes. At first sight one is convinced of the specific identity, and this impression only becomes stronger on closer examination.

More dubious are some other branch-systems, occurring on the same slab and of general forms as shown in the text-fig. 1. They are long and slender, branching dichotomously or sometimes pseudo-monopodially. In some cases they bear short thorns, as shown in one of the drawings. The mode of ramification is rather different from that of the specimens mentioned above; but there seem to be various transitional stages, and for this reason, and on account of the spines, I am inclined to think that they belong together.

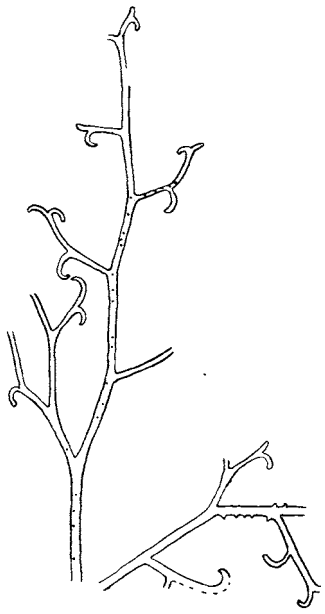

Fig. 2. *Hostimella* resembling the form associated with *Dawsonites Ellenae*. Thorns are distinct in some places along the margin, and scars are numerous (only some of them are drawn). From the northern side of the Gjegnalund Glacier, leg. O. A. H. 1930 (PA 205.) — Nat. size.

In the older collections (from 1930) there are several specimens resembling this type of *Hostimella*, all of them sterile, but in some cases showing points of interest. One of them (PA 99) was found to the east of Lake Svartvatnet, about 700 m above sea level, loose among the other pieces of rock. The others are from the northern side of the Gjegnalund Glacier. In some cases we have branch-systems of this kind (a pseudo-monopodial axis with dichotomous side-branches and recurved tips) associated with stems of a certain type of *Aphyllopteris* (which I do not think is identical with those forming part of *Asteroxylon elberfeldense*); but there is no instance of organic connection between the latter and Hostimellas doubtlessly identical with the new one from Devonskardet, so that one is scarcely allowed at

present to draw any conclusions from this fact. — On the other hand there are good specimens of *Thursophyton* (especially PA 77) mixed with ultimate ramifications which doubtlessly belong to these stems, but which resemble the new specimens from Devonskardet (e. g. Pl. 1 fig. 2) except in being still more slender and probably also more spinose. The specimen (PA 205) reproduced here as text-fig. 2 most likely also belongs to *Thursophyton*, but apart from its slenderness and the great number of spines it has a considerable resemblance to the new one from Devonskardet; it was found on a small slab together with several other branches of the same kind, but without any stems of *Thursophyton*.

Affinity. — In the Nordfjord Flora nothing has been found so far which resembles the fertile parts of the plant described above. It was also impossible to refer our new plant to any of the sterile parts previously found; the resemblance just mentioned is worth noticing, but is not sufficient to give any safe base for combinations at present.

It might, however, be compared with some of the Middle Devonian plants from Scotland and Bohemia, belonging to the genus *Protopteridium* KREJČI, *sensu* KRÄUSEL & WEYLAND (1933):

P. pinnata (LANG) K. W. (*vide* LANG 1925 and 1926),
P. Thomsoni (DAWS.) K. W. (*vide* LANG 1926),
P. hostimense KREJČI *emend*. K. W. (1933).

All these plants, as far as known, terminate in a fertile part, consisting of an axis, apparently monopodial, bearing lateral branches; the latter divide dichotomously, sometimes repeatedly, and bear either pinnate branches or sporangia. In the former case, the sterile, obtuse pinnules have a close resemblance to foliar organs (as expressed in the generic name), but, at least in the Bohemian plant (according to KRÄUSEL & WEYLAND), they are terete, not flat. The sporangia are always linear and usually parallel to each other, all directed to one side. The whole lateral branch-system is curved in a very striking manner, with the convex side outwards. This latter character, and the presence of sterile "pinnules", and above all, the narrow linear form of the sporangia, are all in contrast to the Nordfjord plant, so that a specific identity is out of the question, and it is scarcely advisable to refer our specimen even to this genus. *Protopteridium* is a very well-defined type of plant, and the new species would

considerably widen the concept of this genus and blur its limits. On the other hand there is certainly an undeniable resemblance, and this is the more striking in view of the latest theories about the vegetative organs of *Protopteridium hostimense*: KRÄUSEL & WEYLAND (1933) assume that STUR (1881) was right in combining *Hostimella hostimensis* with *Spiropteris (Protopteridium)*, and their reconstruction of the whole plant in many features corresponds to the idea one can form of our new species.

For the sake of completeness attention may be drawn to a certain resemblance of our plant to *Aneurophyton germanicum* K. W., especially in the form of the sporangium clusters, — compare, for instance, the drawings of KRÄUSEL & WEYLAND 1929 p. 320–321. But the sterile parts and the whole organisation of the plant are quite different. This is still more the case with *Rhacophyton (Sphenopteris) condrusorum* GILK. from the Upper Devonian of Belgium, and other Upper Devonian fructifications, like *Dimeripteris fasciculata* from the Donetz Basin (SCHMALHAUSEN 1894 p. 30).

Among the many other fertile plant fragments from the Lower and Middle Devonian which have become known in late years, there are none showing any closer affinity to the new specimen under consideration. There are, then, two alternatives, — to create a new genus for it, or to place it provisionally in the artificial group called *Dawsonites*.

To institute a new genus would be possible and justifiable; but its fate would perhaps be to become abandoned later, when more is known about the plant to which this fructification belongs. The number of Devonian plant genera is increasing rather seriously, and the list of synonyms should certainly not be overburdened, if evitable.

As to *Dawsonites*, this name, as is well known, was introduced by HALLE (1916) "as a provisional generic designation" for certain sporangium-bearing specimens. To the type species *D. arcuatus* from Røragen in Norway he also referred specimens described from Canada by DAWSON (1871) and from France by BERTRAND (1913). KRÄUSEL & WEYLAND (1930 p. 40) have later attributed HALLE'S fertile shoots to the branches of the *Aphyllopteris*-type occurring in the same place, and called the species *Haliserites arcuata*.

On the other hand, KRÄUSEL & WEYLAND have used the name of *Dawsonites* as a provisional name for other sporangium-bearing shoots, which cannot at the moment be combined with any vegetative

parts sufficiently well defined. The dubious specimen ?*Dawsonites sp.* (KRÄUSEL & WEYLAND 1930, p. 75) is a representative of a very obscure nature, and the same is the case with the one which DAWSON (1882 p. 104) referred to *Arthrostigma gracile* (vide KRÄUSEL & WEYLAND l. c.); both of them have now been included by DORF (1934) in his genus *Bucheria*. A far better specimen was described by KRÄUSEL & WEYLAND (1933) from Bohemia as *D. bohemicus*, and to the same general type one could also refer *Hostimella racemosa* LANG (1925).

Most of these forms are rather different from each other and from HALLE'S species, and at the same time all of them differ widely from the new specimen from Nordfjord. If *Dawsonites* were a natural genus it would be impossible to put all these things together under a common name. But it is no natural genus, and we need such a provisional designation for sporangium-bearing shoots of uncertain affinity, but probably belonging to some psilophyte. It corresponds to *Hostimella*, as this name is used by HALLE (1916) and by KRÄUSEL & WEYLAND (after 1923), and to other artificial groups which paleobotanists have often got to be content with.

It may be objected, however, that the name should be reserved for the *Psilophytales*, and in the present case it is not certain that the new species belongs to this group. Certainly the ramification of the sterile parts, and still more the presence of thorns point in this direction; but the sporangia do not have much resemblance to what is known before from these plants, neither in form nor in position. — One should not, however, be too rigid as to the definition of *Dawsonites;* as a parallel to *Hostimella* it may happen to comprise forms which later turn out to belong to other groups than the real *Psilophytales*.

Our species may then get a preliminary place in the "genus" *Dawsonites*. It is really too well defined for a provisional name like this, but for the reasons mentioned it seems to be the best course at present, and we may also hope that it will not remain in this place for long.

The species is called *D. Ellenae*, because it was discovered by Mrs Ellen Arbo Höeg.

It was found in the lower part of the Devonskardet.

Thursophyton, Aphyllopteris, and *Hostimella.*

In my former paper I offered some remarks on three types of stems and branches comprised in this flora:

1. *Thursophyton.* From the thicker stems with numerous appressed appendages there are all kinds of transitional stages to thin branches and ultimate, slightly circinate tips, partly in connection with each other and doubtlessly belonging to one and the same species of plant. It is noteworthy that these ultimate ramifications are also spinose, although the length of the spines and their number decrease towards the tips.

2. *Aphyllopteris*, naked stems, laterally branched, in various forms. (Certainly it is often, as has been stated by various authors, impossible to draw any sharp limit between these branch-systems and those which are dichotomously branched, but in many cases the name may be useful as a designation for forms of a characteristic appearance, like those of the Nordfjord flora).

3. *Hostimella*, branching mostly dichotomous. Also in various forms.

The organic connection between the *Thursophyton* stems and the other ones has not been found, and the new collections have only strengthened the impression from the older material: That the naked branches belong to several species of plants, and that we do not yet know which of them, if any, should be combined with the *Thursophyton.* If our species is identical with *Asteroxylon elberfeldense* the case is fairly clear. But personally I am not quite convinced of this identity, although it is possible, and I am still inclined to regard the morphology of our plant as rather far from being finally cleared up.

In an abstract, HIRMER (1932) has referred to my remarks from 1931 in such words as if I were doubting the correctness of the reconstruction of *Asteroxylon elberfeldense* by KRÄUSEL & WEYLAND (1926). I regret to have expressed myself so as to make this misunderstanding possible. In the case of the said species the connection between spinose stems and naked branches is a well established fact, beyond all discussion. My reservation only applied to the Norwegian plant, and in spite of the light which the German discoveries have thrown upon the latter, and in spite of the new collections, I still think it is advisable to quote our species with a "cf."

I should like to avail myself of this opportunity to correct a very unfortunate error in my former paper, to which Professor Kräusel has first directed my attention: The specimen (PA 84) called *Arthrostigma* sp. (l. c. Pl. I) is certainly a stem of *Thursophyton*. Whether it is identical with the common species is not certain. It is fragmentary and rather poorly preserved.

I also agree with Professor Kräusel in another criticism: That the specimen which I mentioned under the name of "cf. *Thursophyton Milleri*" (l. c. Pl. II figs 1 & 2) should rather be called *Hostimella*. I gave it the former name only to express the possibility of its forming part of the same plant as *Thursophyton*. But of course, at the same time it is a typical *Hostimella*, as was also said explicitly in the text.

Hyenia sphenophylloides NATH.

Pl. III.

PA 1085 a—e are parts of one piece of rock, containing several fragments supposed to belong to one and the same species of plant. It was found on the northern side of the Gjegnalund Glacier.

The best one (PA 1085 e, Pl. III fig. 1) is a branch, about 8 cm long, measured along the curve. The strong main axis gives off a large number of what may be called leaves; in the upper part they are opposite or perhaps verticillate (Pl. III fig. 3), while in the lower part they distinctly give the impression of being spirally arranged. The stem is not articulate. The leaves are about 18 mm long, and being curved in all directions they cross each other on different levels in the matrix. They branch with strict dichotomy, usually twice, but in some cases perhaps once more. The divisions are equally long and often lay closely together in a little pencil-like bundle, but, as is visible in two places on Pl. III fig. 3, the two main parts may also spread out at an angle of nearly 180°. The lower half of the leaf is simple, like a kind of stalk, the first forking taking place about the middle of the leaf. Their breadth cannot be ascertained clearly on this specimen, because they are often incrustated with some rust. In some cases the extreme tips can be observed as very thin and probably terete, hairlike divisions; that may be due to the preservation of some central strand only, the surrounding parenchyma being lost.

In another little specimen, PA 1085 c (Pl. III fig. 4), the leaves are 0,5 — 0,9 mm broad; in this case there is no reason to doubt that what we see is the original breadth of the leaves. Sometimes in this specimen they are nearly opposite; in the middle of the photograph there is a good example of this; but even in this case the leaf on the left hand side is realy a little lower than the other one, and in other cases the difference in level is more considerable.

That the two specimens mentioned belong together is beyond doubt; but it might appear more uncertain in the case of PA 1085 b, Pl. III figs 5—6, which is chiefly a naked stem; in the upper end, however, which is on a lower level than the rest, there are traces of leaves of the type just described, so that the identity is established also here. It seems to have been partly decayed before fossilization, and what is left is a kind of macerated preparation of some more resistant parts, which may be regarded as vascular strands. The remarkable point is a very distinct articulation: In the internodes are usually seen four strands; they seem to fuse in the nodes, and in some cases there are faint indications of an alternation, although the latter features are not distinctly observable.

The other specimens strenghten the impression of the regular dichotomy of the leaves, and their variable arrangement, being sometimes verticillate, sometimes scattered (probably in spirals) along the stem.

Affinity. — Some of the specimens have a close resemblance to NATHORST's type specimens of *Hyenia sphenophylloides* (compare, for instance, our Pl. III figs 3 and 4 with his Pl. IV figs 2 and 3), and our plant can safely be referred to this species. The leaves, however, are more divided than in those described by NATHORST, and in so far it forms a link with *H. elegans* K. W. But still it is decidedly more related to the former than to the latter, and it has by no means such an intermediate position that it could justify a combination of the two species. On the other hand one must agree with KRÄUSEL & WEYLAND (1926 p. 135) in questioning the taxonomical value of the said character.

Till now, the genus *Hyenia* has been recorded only from Western Norway, Germany (Rhine District), and Belgium (ADERCA 1932, compare KRÄUSEL & WEYLAND 1932 p. 277).

— I should like to draw attention to the far-going resemblance of our specimens to the Middle Devonian *Haspia devonica* K. W.

(1929 p. 342, Pl. 13 figs 3—4, text-fig. 23). The leaves of the latter are of the same size, and they are forked, once or usually twice; in the latter case one of the first divisions is quite short (in contrast to our species, where they are always equal). Further, there is the same anatomical structure, with a central strand surrounded by some softer external tissue; to judge from the admirable photograph of *Haspia* (K. W. l. c. Pl. 13 fig.4) this central strand may sometimes be thickened in the apical part of the leaf, just as in the new specimen from Nordfjord. — The difference between *Haspia* and *Hyenia* should be the spiral arrangement in the former, in contrast to the verticils in the latter. Now the leaves are distinctly verticillate in some parts of *Hyenia*; but especially in the upper portion of the stems, and towards the base, it is often equally distinct that they are not. This fact has been mentioned already by NATHORST, and it is also well visible in some of the drawings and photographs of KRÄUSEL & WEYLAND, for instance 1926 p. 134, figs. 16 b. This last-named figure has a striking resemblance to *Haspia*, and upon the whole, in wiev of the variable disposition of the leaves in *Hyenia*, I am inclined to search the allies of *Haspia* in the close neighbourhood of this genus.

The bearings of the articulation of the stem described above could scarcely be estimated rightly at present, and at all events it does not contrast with what is here said on *Haspia*.

Pectinophyton norvegicum, n. gen., n. sp.

Pl. IV, text-fig. 3.

The specimen PA 1084 (Pl. IV) is poorly preserved in the form of an impression, more or less indistinct, in a sandstone with rather rough surface.

It consists of a stem, about 5 mm broad at the base and 11 cm long. It is nearly straight, but branched, with lateral branches at acute angles alternately to the two sides or possibly in spiral arrangement. Most of the branches are broken or indistinct, but three of those on the right hand side are better preserved and show a remarkable structure; this is particularly the case with the longest one. It curves out from the stem, and on its under side it bears a series of bodies in a dense, pectinate arrangement. These bodies are about 3 mm long. Each of them consists of a stalk (or scale), the tip of which

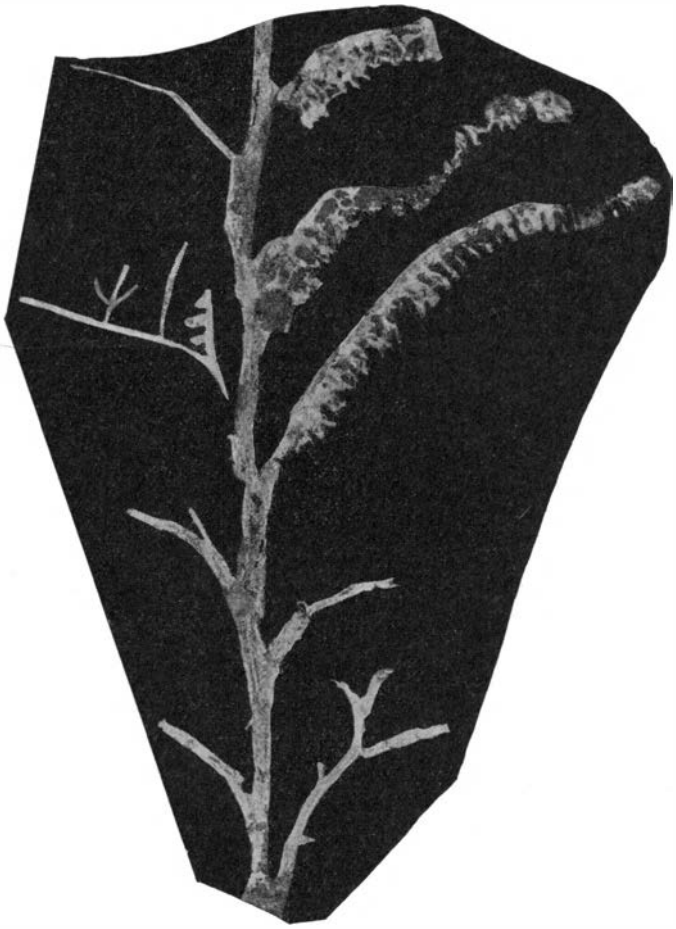

Fig. 3. *Pectinophyton norvegicum*, n. gen., n. sp. Holotype (PA 1084). The photograph Pl. IV fig. 1 retouched. — Nat. size.

is widened and sometimes apparently trilobate. The lobe or process on the distal side often has the form of a hook, more or less incurvate; in some instances, as seen on Pl. IV fig. 3, it is prolonged so as to reach the main branch. One gets the impression that there may have been a sporangiophore, which, on its distal side, has borne a spore-case, and near the end of the branch (to the right in Pl. IV fig. 2) there are suggestions of a surface view of such a structure;

but the interpretation is not more than a working hypothesis and scarcely even that.

Further up, on the same side, there are two more branches of the same kind, but still more poorly preserved.

The other branches do not have these appendages, but they are branched in remarkable ways. The most distinct one is the third from below, on the left hand side. It could be traced for some distance into the matrix, and it was found to give off three branches of higher order, all of them directed upwards; they are more or less parallel to the stem, but do not really lie in the same plane. At the first point of division the main branch makes a bend, but further out it does not change its direction when dividing, and it has here a uniform thicknes, about equal to that of the three branches (the third of which is very indistinctly seen). The first (innermost) of these branches is very remarkable (Pl. IV fig. 4), bearing short branches or pinnules. They could only be found on one side, distal in relation to the stem; on the other side they could not be seen with certainty, although there are faint indications of such structures. Three of these appendages could be prepared free of the matrix, and probably there are more of them; but further preparation had to be desisted from for fear of doing damage to the rest of the fossil. They are at about right angle to the branch, obtuse, and they appear to have been thick bodies, but no sporangium wall or remains of spores could be found, to support their interpretation as sporangia. In shape, size, and position they are rather similar to the appendages on the long pectinate branches, but they differ in standing farther apart, and it is not very probable that they are of the same nature.

The other main branches are more simple or incomplete. Number two from below, on the left hand side, gives off a branch in the same direction and in the same position as the one with appendages just described; but so far as it could be traced into the matrix no such structures were found in connection with it. — On the second branch from below, on the right hand side of the main axis, there is a very distinct, thick body of an ovate shape, 2,2 mm long; it is situaed on the upper side of the branch, just where it makes a bend. It has, probably quite accidentally, a close resemblance to the bud-like axillary structures found in many Hostimellas; certainly it its the base of a broken branch, or an undeveloped one. — The lowest main branch, on the same side, is also divided; there seems to be a repeated

dichotomy, probably in various planes, but no certainty could be gained on account of the poor preservation.

Further, it is worth mentioning that there are a few scattered thorns on the stem. One of them is seen on the left hand side, above the first branch; another one is found at the base of the long pectinate branch. These two are directed obliquely downwards, but with the other ones, which are few and indistinct, it is not certain that this was the case.

Affinity. — The real nature of the pectinate branches cannot be made out, but judging from the general appearance of the plant it was very probably fertile, the sporangia being borne on the lower side of the branches, as it seems in connection with short scales or pedicels. But even if this interpretation be correct, we have very few clues for judging of the relationship of this plant. It could be compared with *Barinophyton*, which WHITE (1905) described from the Upper Devonian of Maine; but, among other differences, the latter is said to have its sporangia in two rows on the *upper* side of the branches, as in *Archaeopteris*; probably the resemblance is quite superficial.

Our plant cannot be grouped under *Dawsonites*. In the case of *D. Ellenae*, described above, this was still practicable — although the correctness may be disputed —, because we had then to deal with a plant of possible Psilophytean affinity; but this can certainly not be said about the specimen under consideration. It is tempting to list it only as "Incertae sedis". But it seems as if we have got to deal with quite a new type of branch-systems, and in order to facilitate reference in future I prefer to give it a new generic name, even if the diagnosis is at present rather incomplete.

The main features, as known so far, are as follows (which of these characters are of generic importance cannot be said at present):

Pectinophyton, n. gen. Monopodial stem, sparsely thorned and with lateral branches. The sterile branches repeatedly divided (dichotomously?), sometimes bearing unilateral appendages (pinnules?). Fertile branches with a large number of sporangia (?) on the lower side, probably in connection with and distally to scales or pedicels.

P. norvegicum, n. sp., from Devonskardet on the eastern side of the Gjegnalund Glacier.

As to the plant of which this supposed fructification formed part, it would be natural to draw *Barrandeina pectinata* into consideration, although the mode of branching is rather dissimilar in the two forms. KRÄUSEL & WEYLAND (1933 p. 24[1]), however, have pointed out the possibility that *Brøggeria* is the fructification of the said species (while *Psygmophyllum Kolderupi* is probably the foliar parts of it). Now it is impossible that *Pectinophyton* is identical with *Brøggeria*, even as a certain stage of development or a particular state of preservation, and consequently it is not very likely that our new form has anything to do with *Barrandeina*. — There is no other plant known from the Nordfjord Flora which suggests itself as a possible mother plant of *Pectinophyton*, and the question of its real position must be left quite open at present.

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[1] *Barrandeina* is l. c. erroneously talked of as occurring at Røragen, the locality being Nordfjord.

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Explanation of the Plates.

The photographs are not retouched.

The specimens belong to the Paleontological Museum of the University, Oslo.

Plate I.

Fig. 1. *Dawsonites Ellenae* n. sp. Holotype, PA 1083. — Nat. size.

Figs 2—7. Sterile branch-systems (*Hostimella*), supposed to belong to *Dawsonites Ellenae* and found on the same slab, PA 1083. — Nat. size.

Printed April 30th, 1935.


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Plate II.

Details from Pl. I, all magnified × 4.

Figs 1—2 from the long fertile shoot in Pl. I fig. 1, showing clusters of sporangia.

Fig. 3. Another fertile branch on Pl. I fig. 1, with three young clusters of sporangia, two to the left, one to the right. Main axis with spines.

Fig. 4. Part of the sterile branch-system Pl. I fig. 2, with spines.

Fig. 5. Detail from Pl. I fig. 7. The dot on the upper part of the branch to the right is probably the scar or base of a spine.

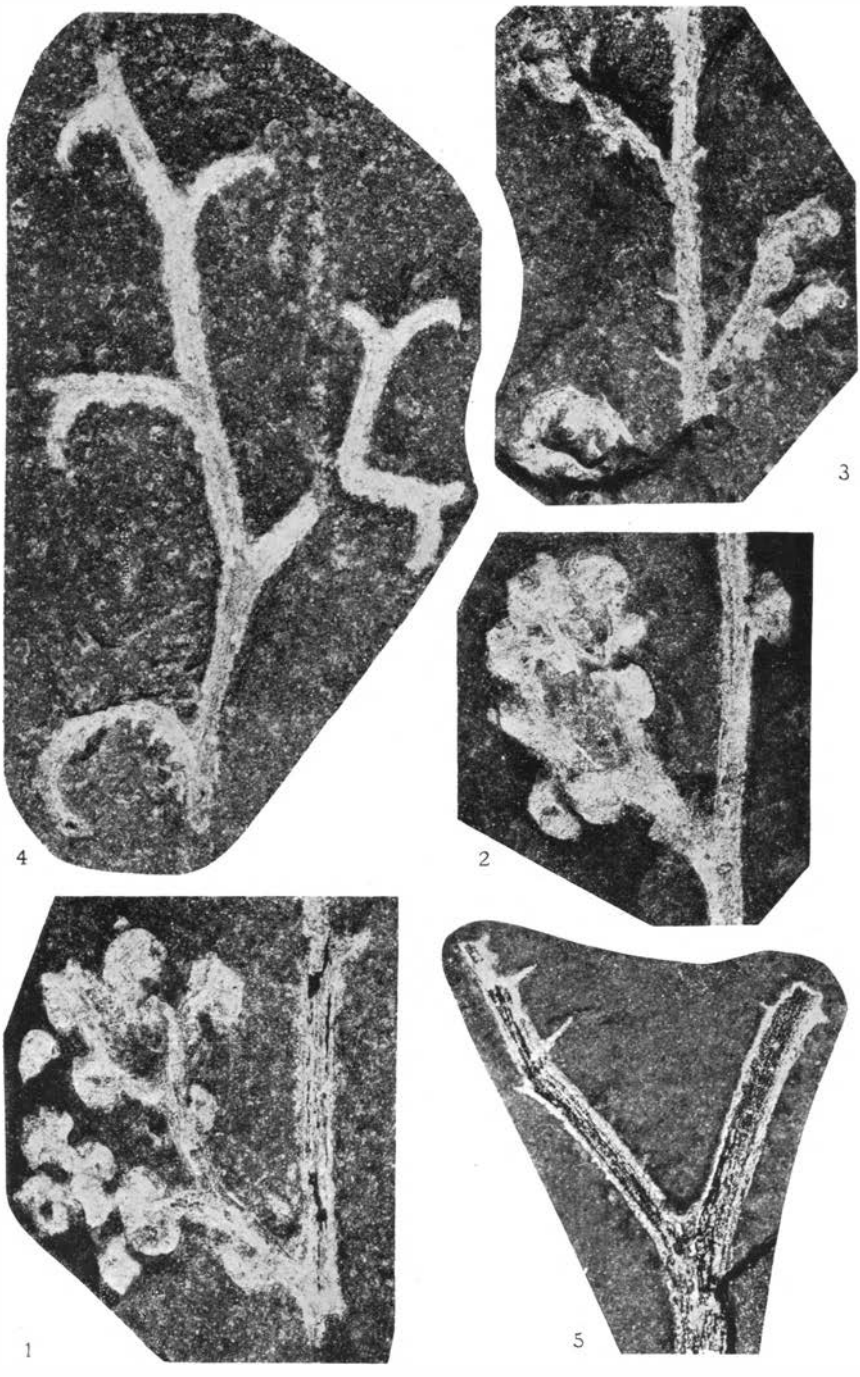
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Plate III.

Fig. 1. *Hyenia sphenophylloides* NATH. PA 1085 e. — Nat. size.

Figs 2—3. Details from fig. 1. — × 3.

Fig. 4. The same species, in another part of the same piece of rock, showing the breadth of the leaves. PA 1085 c. — × 3.

Fig. 5. The same species, in another part of the same piece of rock. Stem, chiefly consisting of remains of (vascular?) strands, which are separate in the internodes. The nodes are distinct, but no connection between the strands is unquestionably visible (compare the text p. 11). The poorly preserved remains in the uppermost part of the fossil are supposed to be leaves. — Nat. size.

Fig. 6. Detail from fig. 5. — × 2,5.

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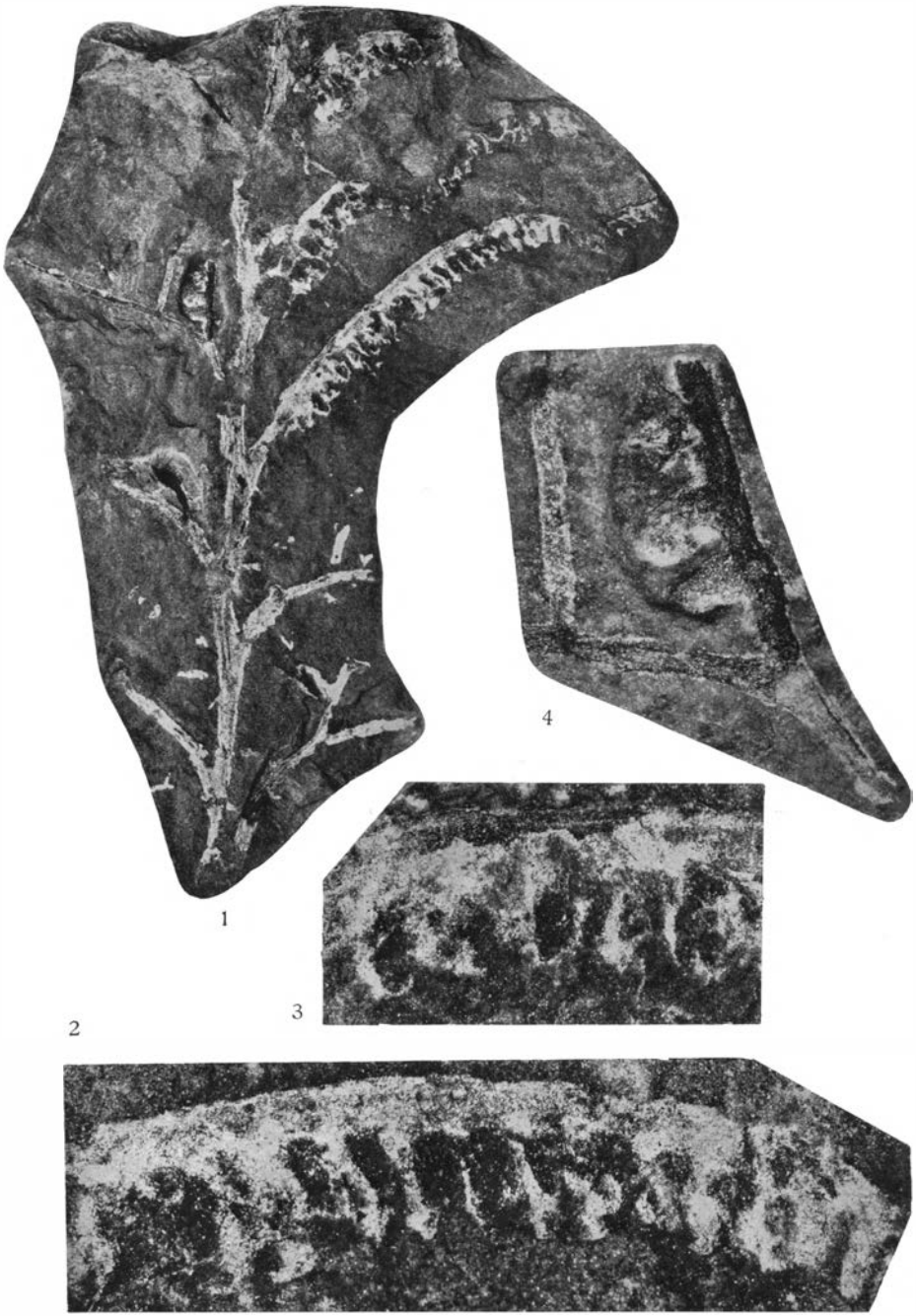
Plate IV

Fig. 1. *Pectinophyton norvegicum*, n. gen., n. sp. Holotype, PA 1084. The same photograph retouched is reproduced as text-fig. 3.

Figs 2—3. Details from the same, showing parts of the long pectinate branch. — × 4.

Fig. 4. Detail from fig. 1. The branch with the pinnule-like appendages is on a lower plane than the simple branch to the left. — × 4.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