

# DICTYONEMA SHALES OUTSIDE THE OSLO REGION

BY  
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WITH 1 PLATE

Abstract: The graptolite *Dictyonema flabelliforme* (Eichw.) has been recorded from Hardangervidda, Holtålen near Røros and Snertingdal north of Gjøvik. The present description of these finds with the associating faunas shows that the occurring species and varieties belong to the Dictyonema Shale (2 e) at the base of the Ordovician.

## Introduction.

Fossil occurrences in the metamorphic sediments outside the Oslo Region are known in a considerable number of cases. Besides the more fossiliferous beds of the Bergen and Trondheim Regions, certain singular occurrences such as Hardangervidda, Otta, Smøla, Hitra, Kjølhauge and others, have been able to elucidate both stratigraphical and tectonic features of great importance. In such cases, however, it is necessary to carry out a detailed and accurate determination of the often badly preserved fossils.

Prof. Dr. Th. Vogt kindly invited me to describe the specimens of *Dictyonema* which he had collected at Holtålen in the Trondheim Region in 1937. The fossil locality was discovered in 1888 by the late Prof. Dr. J. H. L. Vogt and his collection had not been studied in details. Species of the genus *Dictyonema* are not restricted to the characteristic Dictyonema Shale (2 e) at the base of the Ordovician, but might occur even in the Silurian and here partly in abundance. The typical Dictyonema Shale is, however, of particular importance in forming a well marked guide zone at the base of the Ordovician over wide areas of the Northern hemisphere.

Examining the material from Holtålen, I found it necessary for comparison, also to study briefly the faunas of the other Norwegian occurrences of *Dictyonema*. The Oslo Region apparently presents a very complete development of the shale with *Dictyonema flabelliforme*.

It is possible to distinguish several different varieties of the guide fossil and these varieties are characteristic of distinct subzones just as in Great Britain (Bulman 1927—1928). Already in 1907 Fearnside pointed out the presence of several different varieties of the species in different layers of the *Dictyonema* Shale at Krekling, Eiker in Norway. Present studies which I have made of the sections through the *Dictyonema* Shale at Vækerø and Bygdøy Sjøbad near Oslo, have shown that we might distinguish at least 4 subzones. The subzones are distinguished by different varieties of *Dictyonema flabelliforme* just as in Great Britain:

2 e $\delta$	<i>Dictyonema flabelliforme anglica</i>	Bulman
2 e $\gamma$	—	— <i>norvegica</i> (Kjerulf)
2 e $\beta$	—	— <i>forma typica</i> Brøgger
2 e $\alpha$	—	— <i>sociale</i> (Salter)

The zone 2 e  $\beta$  with *D.f. forma typica* is most commonly found and seems to have the greatest thickness.

Outside the Oslo Region the graptolite *Dictyonema* has been found at Holtålen in the Trondheim Region, in two localities on the mountain plateau Hardangervidda and in one occurrence in Snertingdal north of Gjøvik. I have studied these faunas more in detail and the present paper gives descriptions of the species and varieties occurring in these *Dictyonema* Shales outside the Oslo Region.

### Holtålen (Haltdal).

In 1888 J. H. L. Vogt (1889) discovered specimens of *Dictyonema* in a black shale at Nordaunevoll, Holtålen, north of Røros. He demonstrated the find in the Academy of Science in Oslo (Kristiania) and the occurrence is mentioned by later authors such as Carstens (1920) and Kiær (1932). Carstens also collected some specimens, one of which is preserved in the Collections of the Palaeontological Museum which also has the original collection of J. H. L. Vogt. The following description is, however, largely based on the more complete collection made by Th. Vogt in 1937. The fossils belong to Norges Tekniske Høgskole in Trondheim and the occurrence is described by Th. Vogt (1940) in an article preceding this in the same periodical.

*Dictyonema flabelliforme* (Eichwald) var. *sociale* (Salter).

Pl. fig. 6—8.

Preservation. The fossils are preserved in a black alum shale which in weathered state has a greyish colour. The shale has been subject to jointing leaving only elongate, narrow pieces to be obtained. The shape of the fossil specimens indicates that the shale has been compressed at a more or less right angle to the main jointing. The ratio width : length of the *Dictyonema*-colonies is about 1:1.5 when preserved at right angle to the jointing, and about 1:2.7 when preserved parallel to it.

The fossils are not well preserved. The branches (stipes) of the colonies (rhabdosomes) are visible especially in slightly weathered specimens such as in fig. 6 and 8 of the plate. Only in a few cases the cross-bars (dissepiments) of the stipes are visible. The preservation of the graptolites as glistening films, such as in the shales of the Oslo Region, is only indicated in some specimens such as the one shown in fig. 7 of the plate.

Description. The shape of the rhabdosome is narrow vasi-form with the sides becoming almost parallel in the distal portion. The ratio width : length, apart from the deformation due to preservation, seems to be 1:2.1 in average. The stipes are very fine and close set. In the narrow rhabdosomes more than 20 has been counted in 10 mm, but this might be due to the preservation of both sides of a funnel-shaped colony. The average number of stipes in 10 mm is 14—16. The dissepiments are not distinct, but seem to be close set with 10 or more in 10 mm. The cells are not distinguishable.

Relationship. The described form corresponds to the descriptions of *Dictyonema flabelliforme sociale* (Salter). Both the shape of the rhabdosome and the number of dissepiments are the same while the number of stipes is somewhat greater than in the typical specimens described by Bulman (1927—1928).

The probable presence of *Dictyonema flabelliforme sociale* suggests that the Røros Shale of Holtålen belongs to the basal part of the Dictyonema Shale (2e  $\alpha$ ) at the very base of the Ordovician.

## Holberget, Hardangervidda.

In 1859 Tellef Dahl (1861, p. 170) discovered *Dictyonema flabelliforme* in phyllitic shales at Holberget on the plateau Hardangervidda about 100 km OSO of Bergen. The fossils were figured by Kjerulf (1865, fig. 2, 3) who established a new species now regarded as a special variety *D. f. norvegica* (Kjerulf). The description of the new form was based on specimens from Holberget and Tøien, Oslo. (On account of preservation it seems natural to choose a lectotype among specimens from Tøien.) Brøgger (1882, p. 36) mentions the specimens of Holberget in his detailed description of the forma *typica* of the species. He includes the specimens in the forma *typica*, but states that transition formes between forma *typica* and var. *norvegica* occur. Brøgger (1893, p. 15) made new collections at Holberget and succeeded in finding the fossiliferous bed which had not previously been traced.

Additional material was collected by Rekstad (1903, p. 21). Besides graptolite specimens he found fragmentary brachiopods (see below). It is possible that these fragmentary brachiopods are identical with badly preserved fossils, found at a somewhat lower level, among which he ment to trace remains of trilobites (Asaphidae).

*Dictyonema flabelliforme* (Eichwald) var. *norvegica* (Kjerulf).

Pl. fig. 1, 2.

*Dictyonema norvegicum*. Kjerulf 1865, p. 1, fig. 2, 3.

*Dictyograptus flabelliformis* Eichwald, forma *typica*. Brøgger 1882, p. 36.

**Preservation.** The fossils occur in a black phyllitic shale. The graptolites are strongly flattened, but have also been subject to horisontal stress as shown in fig. 1 on the plate. In spite of the considerable compression, however, the fossils are comparatively well-preserved.

**Description.** The large and coarse-meshed colonies attained a length of stipes exceeding 150 mm and a width of rhabdosome even greater still. Certain large specimens show that the rhabdosome is characteristic by its less diverging initial portion and a constantly diverging distal portion. The outer borders, which are but slightly

convex, form an angle of about  $90^\circ$ , giving the colonies a subtriangular outline in preserved state. The stipes are uniform and parallel. The density of stipes are dependant on the compression, and the measured variation of 5—9 in 10 mm should therefore be limited to 6—8. The dissepiments are rather constant in number, about 5 in 10 mm, but they vary considerably in thickness as shown in fig. 1 and 2 of the plate. Fig. 2 has the thick cross-bars characteristic of the variety, while the other in fig. 1 resembles the forma *typica*, although certain thicker dissepiments are always traceable. The latter form evidently induced Brøgger to include the form of Holberget in the forma *typica*.

Relationship. The described form, which represents the bulk of the graptolites at Holberget, belongs to the variety *Dictyonema flabelliforme norvegica*. Transition forms pointing to the forma *typica* occur just as in Great Britain (Bulman 1927—1928, p. 26).

*Dictyonema flabelliforme* (Eichwald) forma *typica* Brøgger.

Besides the above described variety certain specimens from the collections of Brøgger and Rekstad show also the presence of the forma *typica*.

*Clonograptus* sp. (?)

Certain pieces of shale contain numerous fragments of single branches or stipes which probably belong to branched graptolites of the *Clonograptus* or perhaps *Anisograptus* type (Ruedemann 1937).

*Obolus* sp.

Pl. fig. 3.

The material collected by Rekstad contains a number of specimens which apparently represent the compressed remains of inarticulate brachiopods. Certain shells have a slightly blueish colour indicating phosphatic shells. Fig. 3 on the plate shows one of the specimens which has an ovate outline with a length of 4 mm and a width of 8 mm. The concentric striæ are distinct, but may in certain cases have been accentuated by the stress of the shale. The preservation of the specimens does not permit a distinct determination, but the brachiopods resemble in shape and size the species *Obolus (Brøggeria) salteri*

Hall which occurs in the Dictyonema Shale and Ceratopyge zones in the Oslo Region.

The fossils of Holberget show that the shale belongs to the Dictyonema Shale (2e) and mainly the upper part (2e  $\gamma$ ) of this basal zone of the Ordovician.

### Dvergsminut, Hardangervidda.

In 1902 Rekstad (1903, p. 21) discovered a new *Dictyonema*-locality at Dvergsminut 20 km south of Holberget on Hardangervidda. In his description of the locality he mentions the presence of the fossil *Dictyonema flabelliforme*.

*Dictyonema flabelliforme* (Eichwald) forma *typica* Brøgger.

Pl. fig. 5.

Preservation. The black shale is similar to that of Holberget, but the fossils are less compressed. A secondary schistosity is indicated.

Description. Rhabdosomes of this form is common in the material. One specimen (No. 287 PMO) shows an outline of the rhabdosome corresponding to the maximum dispersion given by Bulman (1927—1928, text-fig. 12) of the forma *typica*. The basal portion of the rhabdosome shown in fig. 5 (to the left) on the plate, has an even greater dispersion which might indicate the variety *D. f. anglica* Bulman, but the angles might also to a great extent be due to an oblique preservation. The other specimen in fig. 5 shows the typical stipes and dissepements of the forma *typica*. The number of stipes is 8—9 in 10 mm, and the number of dissepements 4 in 10 mm.

Relationship. The bulk, if not all of the specimens belong to *D. f. forma typica*. Certain broad rhabdosomes in the material might possibly belong to *D. f. anglica*.

*Bryograptus kjerulfi* Lapworth (?)

Pl. fig. 4.

The figured specimen probably belong to this species which occurs in the upper part of the Dictyonema Shale of the Oslo Region. The narrow rhabdosome measuring 29 mm in length, has close set

stipes branching at small angles and lacking the dissepiments characteristic of the genus *Dictyonema*. A distinct determination is not possible, but the regular stipes and the shape of the rhabdosome suggest this species more than others described from similar beds (Westergård 1909 and Monsen 1925).

*Clonograptus* (?) sp.

As in Holberget singular graptolite branches occur which might belong to the genus *Clonograptus* or similar forms.

The fossils of Dvergsminut show that these beds belong to the Dictyonema Shale (2 e). Besides the subzone 2 e  $\beta$ , slightly younger fossiliferous beds seem to be present.

### Snertingdalen.

In his paper on the Cambrian beds of the Mjøsen District Strand (1929) mentions the find of *Dictyonema flabelliforme* in a road cut just north of Sten farm in Snertingdal northwest of Gjøvik. The locality thus lies outside the Oslo Region. Dr. T. Strand has kindly permitted me to describe the occurring species.

*Dictyonema flabelliforme* aff. *norvegica* (Kjerulf).

Pl. fig. 9, 10.

Preservation. In spite of their occurrence in a district with considerable overthrusts, the fossils in the black shales are well preserved. As a rule the graptolites are compressed into glistening films, but in a few cases they are more plastically preserved showing the cells as shown in fig. 9 of the plate.

Description. The outline of the rhabdosome is not well demonstrated in the specimens preserved, but the divergence of stipes in several fragmentary specimens shows that the outline probably was subtriangular in preserved state just as in *D.f. norvegica*. The thick stipes are usually somewhat irregular as demonstrated in fig. 9 on the plate. In larger specimens (fig. 10) the stipes are more straight such as in ordinary types of *Dictyonema flabelliforme*. The number of stipes is 8—12 with 8—9 in 10 mm as the most common.

The dissepements are subject to variation. As shown in the photographs they appear both as thin threads and solid cross-bars. Certain oblique bars may have served as anastomosing branches between the stipes. A small fragment has very broad dissepements such as in extreme forms of *D. f. norvegica*. The number of dissepements is 4—5 in 10 mm. The number of thecæ is 19—20.

Relationship. The described form shows distinct affinities to *Dictyonema flabelliforme norvegica* which has a similar shape of the rhabdosome and a corresponding development of the dissepements. The thin dissepements, so common in most of the specimens, indicate an intermediate form similar to one described by Bulman (1927—1928, text-fig. 14) from Great Britain. On the other hand the less regular stipes, which is partly significant also in the British form, point to a possible connection with the variety *D. f. desmogrptoidea* described by Hahn (1912, p. 139) from America.

The described graptolite species from Snertingdal evidently belongs to the Dictyonema Shale (2 e) and probably the middle part of this zone (2 e  $\beta$ — $\gamma$ ).

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## Explanation to the plate.

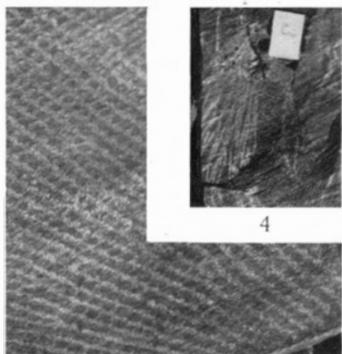
Reproduced photographs not retouched. Specimens figured in natural size.

- Fig. 1—2. *Dictyonema flabelliforme norvegica* (Kjerulf). Holberget, Hardangervidda. T. Dahl coll. No. 261 Pal. Mus. Oslo Coll.
- Fig. 3. *Obolus* sp. Several specimens from Holberget, Hardangervidda. J. Rekstad coll. No. 274 Pal. Mus. Oslo Coll.
- Fig. 4. *Bryograptus kjerulfi* Lapworth (?). Dvergsminut, Hardangervidda. J. Rekstad No. 281 a Pal. Mus. Oslo Coll.
- Fig. 5. *Dictyonema flabelliforme* forma *typica* Brøgger. Dvergsminut, Hardangervidda. J. Rekstad coll. No. 284 Pal. Mus. Oslo Coll.
- Fig. 6—8. *Dictyonema flabelliforme sociale* (Salter). Nordaunevoll, Holtålen. Th. Vogt coll. The specimens belong to Norges Tekniske Høgskole.
- Fig. 9—10. *Dictyonema flabelliforme* aff. *norvegica* (Kjerulf). Snertingdal. T. Strand coll. No. 35874, 35914 Pal. Mus. Oslo Coll.

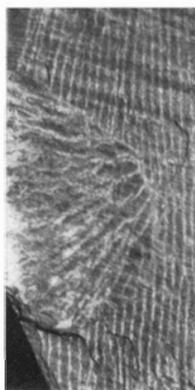
Leif Størmer: Dictyonema Shales Outside the Oslo Region



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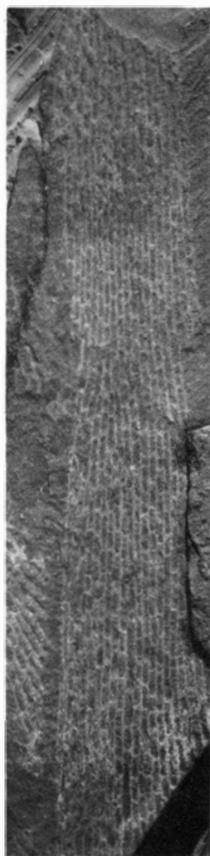
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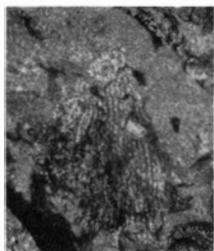
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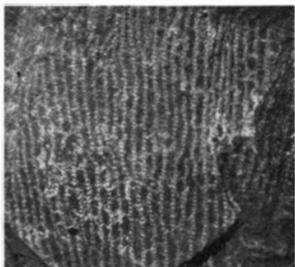
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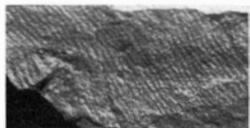
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