Liassic ferns from the Steierdorf Formation, Anina, Romania

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Abstract

The Upper Hettangian-Sinemurian palaeoflora from Anina (Banat County, Southern Carpathians) is a remarkable rich flora known and studied since 1850. It belongs stratigraphically to the Nilsonia orientalis *Assemblage Zone and palaeobiogeographically to the European Province, with Siberian influences. The studied material has been collected by the author since 1990 from underground mining horizons or from the Ponor quarry and additionally from the mining dumps. The ferns are well represented and part of the recorded forms are presented, belonging to four groups: Dipteridaceae, Matoniaceae, Dicksoniaceae and Incertae Sedis.*

Introduction

The Anina locality is situated in the south-western part of Romania, the Banat region, in the Southern Carpathians, 35 km South from Resita. The old name of the town is Steierdorf (name given by the Austrian miners, colonists from the Steiermark land, more than 200 years ago). Since long it has been known that fossil plant remains occur in the area.

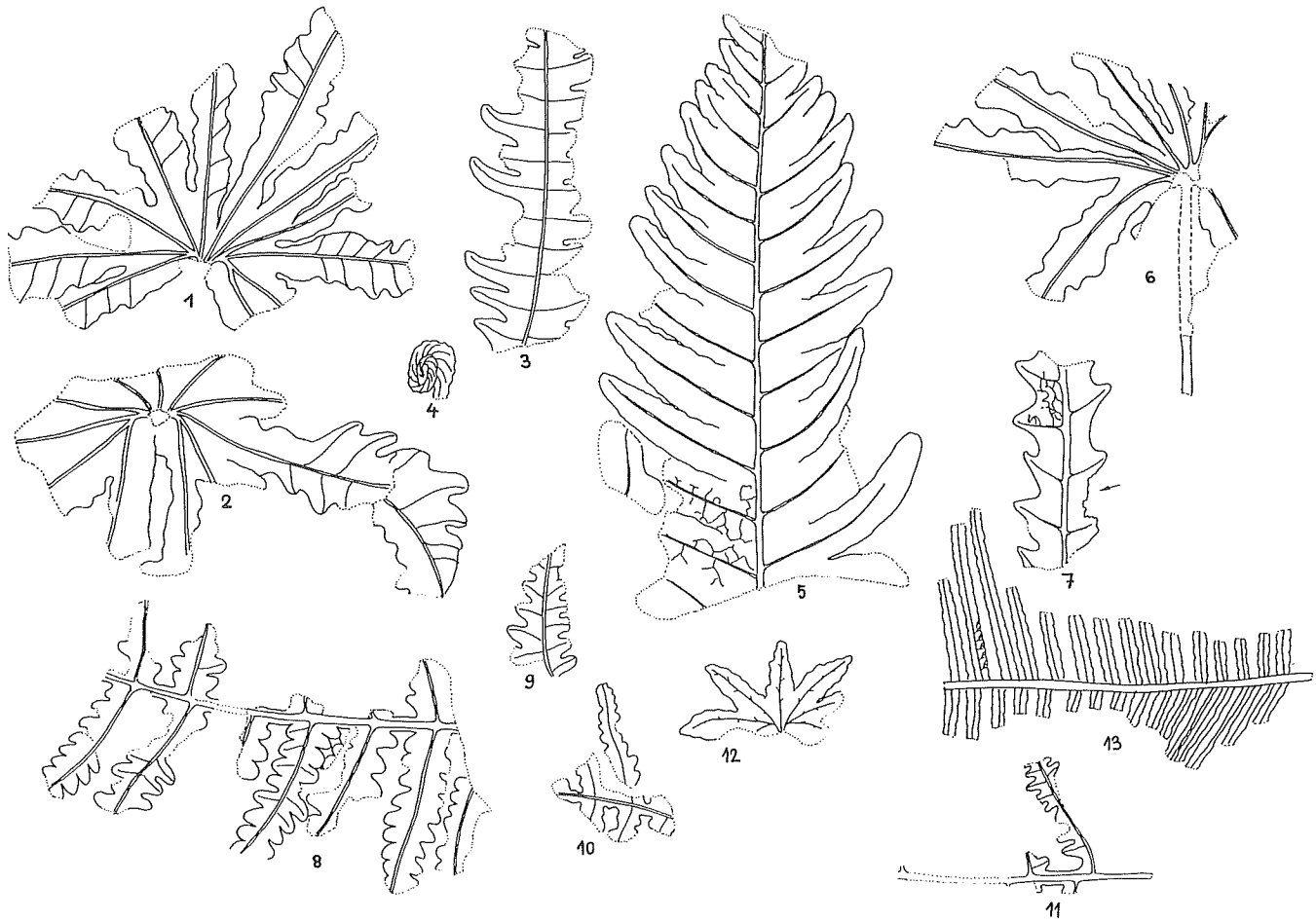
Palaeobotanical research history of Anina

Since 1850, when Foetterle published the first paper on the Anina flora, a number of researchers worked on material from this area: von Ettingshausen (1852), Andrae (1855), Stur (1870), Krasser (1921), Semaka (1962), Givulescu (1989), Givulescu & Czier (1990) and others. The present author is engaged in a study of the Anina flora since 1990 (Popa 1992; Givulescu & Popa 1994).

Geological remarks

The Liassic sediments overlay the Permian red sandstone continental deposits, and they are represented by the Steierdorf Formation. The age of the Steierdorf Formation is Late Hettangian-Pliensbachian and it comprises the following members (Bucur 1991):

1 The Dealul Budinic conglomeratic Member, Late Hettangian in age;



1 Dictyophyllum nilsonii *(Brongniart) Goeppert, P109/C1/120, size X 0,3.*
2 D. nilsonii *(Brngn.) Goepp., P109/C1/57, X 0,3.*
3 D. nilsonii *(Brngn.) Goepp., P44/C2/S9/30, X 0,3 .*
4 D. nilsonii *(Brngn.) Goepp., crozier, P109/C1/120, X 0,3.*
5 Dictyophyllum nervulosum *(Sternberg) Kilpper, P39/C2/1, X 0,3.*
6 Dictyophyllum irregularis *Givulescu et Popa, paratype, P109/C1/99, X 0,3.*
7 D. irregularis *Giv. et Popa, paratype, P109/C1/68, X 0,3.*
8 Thaumatopteris sp., *P40/C2/3, X 0,3.*
9 Thaumatopteris sp., *P40/C2/9, X 0,3.*
10 Thaumatopteris sp., *P40/C2/S4b/1A, X 0,3.*
11 Thaumatopteris sp., *P40/C2/S4b/1A, X 0,3.*
12 Hausmannia sp., cf. dentata Oishi, *P109/C1/124, X 0,3.*
13 Phlebopteris angustiloba *(Presl) Hirmer et Hoerhammer, P113/C1/75A.*

2 The Valea Tereziei sandstone Member, Sinemurian in age;

3 The Uteris argillitic Member, Pliensbachian in age.

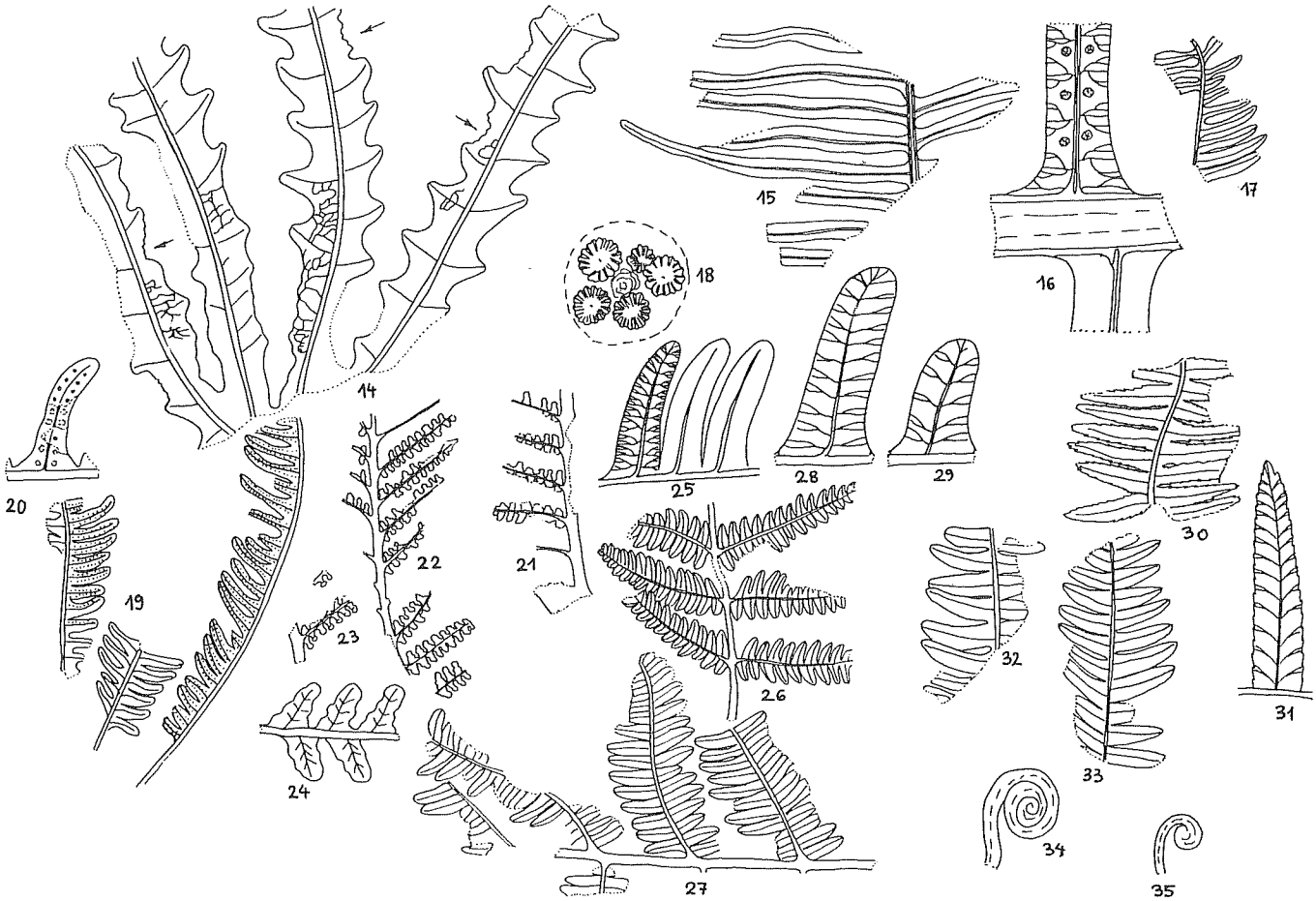
The first two members are in a coal bearing facies that resembles the Austrian Gresten facies, while the third is in a black bituminous shale facies. The first two members bear the plant fossils, the most important from this point of view being the Sinemurian Valea Tereziei Member. This member is palaeobotanically extremely rich, yielding over 100 taxa.

Material

The material is collected from underground mining horizons or from Ponor quarry, specimens are all found in situ, the stratigraphic and taphonomic data being well known. Also some good specimens are secondary collected from the mining dumps. Each sample receives for recording the number of the geological point from where it has been collected, the number of the field notebook, the number of the layer and the order number (e.g. P44/C2/S9/30).

The palaeoflora of Anina

The palaeoflora of Anina belongs palaeobiogeographically to the European Province (sensu Vachrameev 1991), with some Siberian influences, and biostratigraphically it belongs to the *Nilsonia orientalis* Assemblage Zone (sensu Semaka 1965) which is typical for the Sinemurian.



14 D. irregularis *Giv. et Popa, holotype, P109/C1/69, X 0,3.*
15 Phlebopteris woodwardii *Leckenby, P40/C2/S4b/3, X 0,3.*
16 P. woodwardii *Leck., venation scheme, X 1,5.*
17 P. woodwardii *Leck., P40/C2S4b/5B, X 0,3.*
18 P. woodwardii *Leck., sorus, P40/C2/S4b/3, X 12.*
19 Matonia braunii *(Goeppert) Harris, P40/C2/S4b/2, X 0,3.*
20 M. braunii *(Goeppert) Harris, pinnule scheme, X 0,3.*
21 Kylikipteris arguta *(Lindley et Hutton) Harris, P40/C2/2A, X 0,3.*
22 K. arguta *(Lin. et Hut.) Har., P40/C2/S4b/1A, X 0,3.*
23 K. arguta *(Lin. et Hut.) Har., P40/C2/3, X 0,3.*
24 K. arguta *(Lin. et Hut.) Har., venation scheme, X 0,8.*
25 Cladophlebis haiburnensis *(Lindley et Hutton) Brongniart, venation scheme, X 0,3.*
26 Cladophlebis nebbensis *(Brongniart Nathorst, the short type, P109/C1/1, X 0,3.*
27 C. nebbensis *(Brngn.) Nath., the long type, P109/C1/13, X 0,3.*
28 C. nebbensis *(Brngn.) Nath., the long type, venation scheme, X 0,3.*
29 C. nebbensis *(Brngn.) Nath., the short type, venation scheme, X 0,3.*
30 Cladophlebis denticulata *(Brongniart) Fontaine, P39/C1/1, X 0,3.*
31 C. denticulata *(Brngn.) Font., venation scheme, X 0,3.*
32 Cladophlebis haiburnensis f.var ingens *(Harris) Kilpper, P109/C1/3, X 0,3.*
33 C. haiburnensis f.var. ingens *(Har.) Kil., P109/C1/3, X 0,3.*
34 Spiropteris sp., *P44/C2/S9/23A,C, X 0,3.*
35 Spiropteris sp., *P44/C2/S9/54, X 0,3.*

The importance of the Anina palaeoflora is given by: 1. The diversity of plant remains; 2. Their state of preservation; 3. Their density.

The collecting opportunities are very favourable due to the underground mining horizons that offer the great possibility of a three-dimensional study within the Steierdorf Formation deposits, with their plant distribution implications. The Ponor quarry is an open cast mine with rich flora, its southern side being since 1995 a palaeobotanical preserved site, in Anina being also possible to study the material from the mining dumps. The number of taxa surpasses 100. The present paper deals only with the fern taxa that have been collected from the area.

The ferns

The fern taxa that were taxonomically classified belong to four groups:

1. Dipteridaceae:
   - 1.1. *Dictyophyllum nilsonii* (Brongniart) Goeppert 1854, Text-fig. 1, 2, 3, 4.
   - 1.2. *Dictyophyllum nervulosum* (Sternberg) Killper 1964, Text-fig. 5, Plate I, Fig. 1.
   - 1.3. *Dictyophyllum irregularis* Givulescu et Popa 1994, Text-fig.6, 7, 14, Plate I, Fig. 2.
   - 1.4. *Thaumatopteris sp.*, Text-fig. 8, 9, 10, 11, Plate I, Fig. 3.
   - 1.5. *Hausmannia sp.*, cf. dentata Oishi 1932, Text-fig. 12, Plate I, Fig. 4.
2. Matoniaceae:
   - 2.1. *Phlebopteris angustiloba* Hirmer et Hoerhammer, Text-fig. 13.
   - 2.2. *Phlebopteris woodwardii* Leckenby 1864, Text-fig. 15-19, Plate I, Fig. 5, 6.
   - 2.3. *Matonia braunii* (Goeppert) Harris 1980, Text-fig. 19-20, Plate II, Fig.5.
3. Dicksoniaceae:
   - 3.1. *Kylikipteris arguta* (Lindley et Hutton) Harris 1961, Text-fig. 20-24, Plate II, Fig. 6.
4. Incertae sedis:
   - 4.1. *Cladophlebis haiburnensis* (Lindley et Hutton) Brongniart 1849, Text-fig. 25, Plate I, Fig. 8.
   - 4.2. *Cladophlebis haiburnensis f.var. densinervis* Fakhr 1977, Plate I, Fig. 8.
   - 4.3. *Cladophlebis haiburnensis f.var. ingens* (Harris) Kilpper 1964, Text-fig. 32, 33, Plate I, Fig. 9.
   - 4.4. *Cladophlebis nebbensis* (Brongniart) Nathorst 1876, with two types:
     - 4.4.1. The short type, Text-fig. 26, 28, Plate II, Fig. 1.
     - 4.4.2. The long type, Text-fig. 27, 29, Plate II, Fig. 2.
   - 4.5. *Cladophlebis sp.*, cf. nebbensis (Brongniart) Nathorst 1876, Plate II, Fig. 4.
   - 4.6. *Cladophlebis denticulata* (Brongniart) Fontaine 1889, Text-fig. 30. 31, Plate II, Fig. 3.
   - 4.7. *Spiropteris sp.*, Text-fig. 34, 35.

The fern taxa are well represented, ferns being met in all the stratigraphic succession of the Valea Tereziei Member. Dipteridaceous and Dicksoniaceous taxa are frequent in the lower part of this member, Matoniaceous taxa reach the middle part of it and Cladophlebids are stratigraphically uniformly distributed. The following taxa are new for Anina: *Thaumatopteris sp., Hausmannia sp., cf. dentata Oishi, Phlebopteris angustiloba* Hirmer et Hoerhammer, *P. woodwardii* Leckenby, *Kylikipteris arguta* (Lindley et Hutton) Harris and *Cladophlebis haiburnensis f.var. densinervis* Fakhr.

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Photoplate 1

1
Dictyophyllum nervulosum (Sternberg) Kilpper, venation detail, P39/C2/1, X 1,5.

2
Dictyophyllum irregularis Givulescu et Popa, pinnule detail, holotype, P109/C1/69.

3
Thaumatopteris sp., pinna fragment, P40/C2, P40/C2/S4b/1A.

4
Hausmannia sp., cf. dentata Oishi, P109/C1/24, X 2.

5
Phlebopteris woodwardii Leckenby,

6
P. woodwardii Leck., P44/C2/S9/62, X 3.

7
Cladophlebis haiburnensis (Lindley et Hutton) Brongniart, P109/C1/13A, X 2.

8
C. haiburnensis f.var. densinervis Fakhr, P109/C1/23, X 3.

9
C. haiburnensis f.var. ingens (Haris) Kilpper, details, P109/C1/3, X 2.


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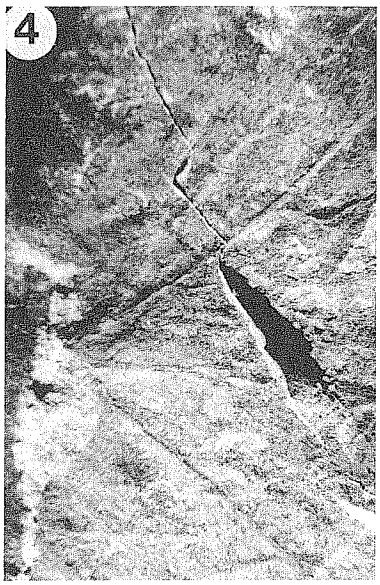
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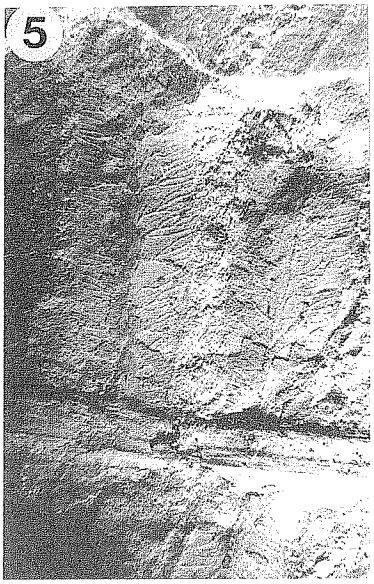
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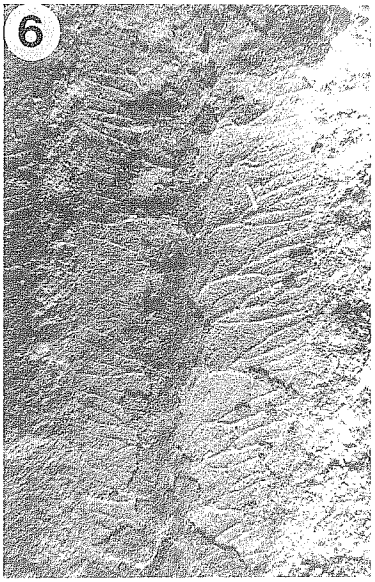
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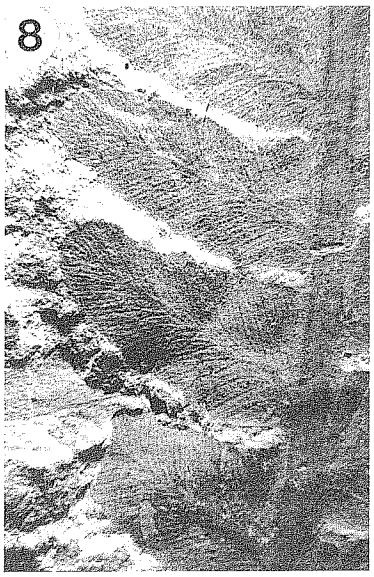
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Photoplate 2

1
Cladophlebis nebbensis (Brongniart) Nathorst, the short type, X 3.

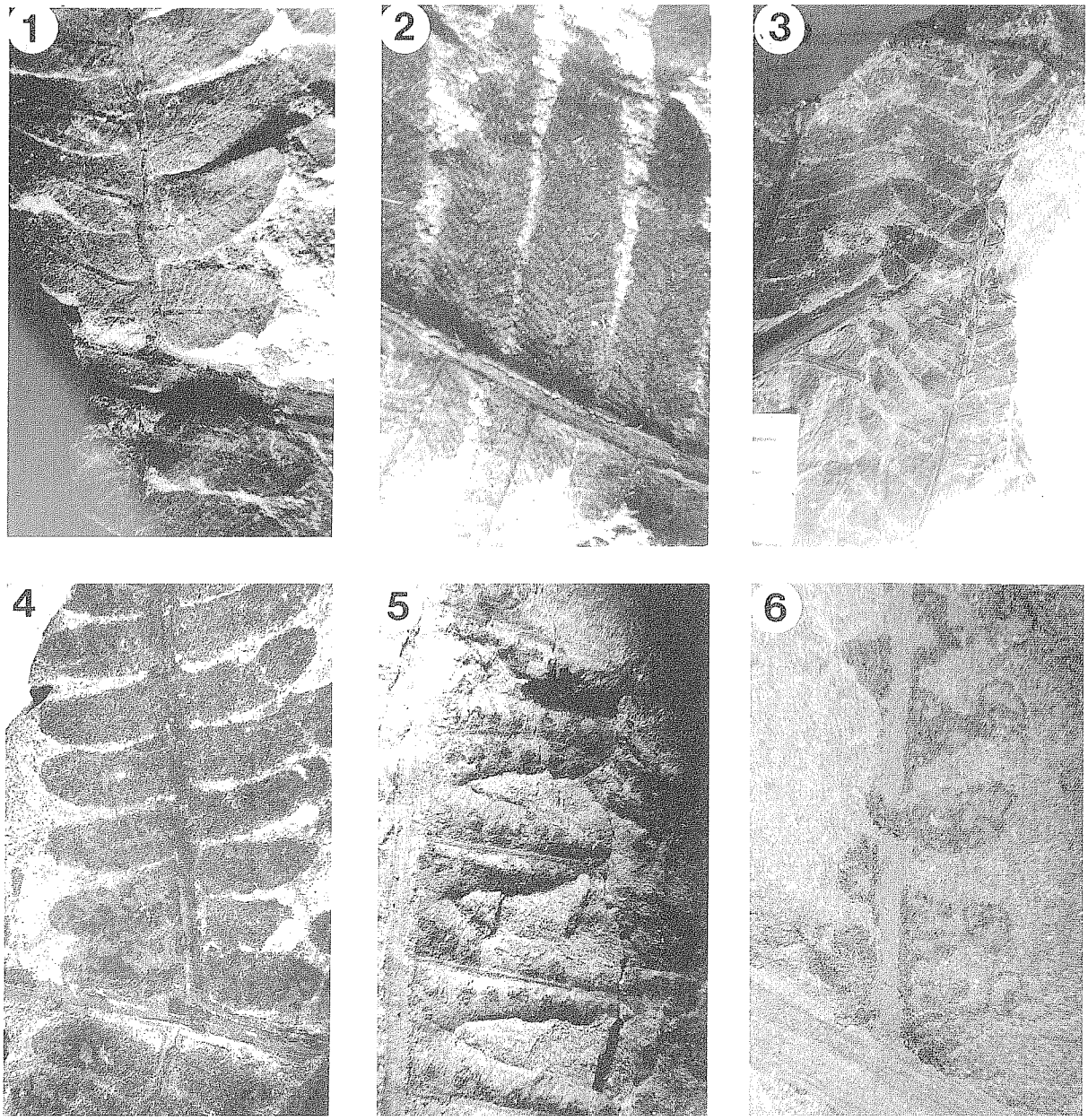
2
C. nebbensis (Brngn.) Nath., the long type, detail, P109/C1/38, X 2.

3
Cladophlebis denticulata (Brongniart) Fontaine, P113/C1/4, X 2.

4
Cladophlebis cf. nebbensis (Brongniart) Nathorst, P109/C1/31, X 2,5.

5
Matonia braunii (Goeppert) Harris, P109/C1/24, X 1,5.

6
Kylikipteris arguta (Lindley et Hutton) Harris, fertile pinnules, P40/C2/3, X 6.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