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# A new Rhaetian flora from the neighbourhood of Coburg (Germany) - preliminary results

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## Abstract

*Preliminary results from a new Rhaetian flora from Heilgersdorf near Coburg (Germany) are presented. Almost 20 natural taxa have been recognized so far, mostly on genus level. Specific determinations, possibly including new species, have still to be carried out. Genera of which one or more species have been recognized so far are: Lepidopteris including its male fructification Antholithus and the female Peltaspermum; Equisetites, Rhizopteris, Todites, Cladophlebis, Phlebopteris, Dictyophyllum, Pachypteris (possibly with an Umkomasia), Nilsonia, Pseudoctenis, Pterophyllum, Taeniopteris, Stachyotaxus, Palissya, Schizolepis and Desmiophyllum. Apart from the fructifications mentioned above, several male and female strobili and a few types of seeds have been found of which the affinity remains to be detected. Coal as well as fusain and permineralized wood have also been recovered. This flora is the most diverse Rhaetian flora so far found in the Germanic Basin.*

## Introduction

Within the renowned flora of the Rhaeto-Liassic boundary beds of Franconia (Germany), the Coburg area has always played a remarkable role, explained by the occurrence of the rare Rhaetian index fossil *Lepidopteris*. In this area these leaves were first assigned as "*Asplenites ottonis*" by Schenk (1867) from the locality Einberg. Schenk also included a single specimen from Spittelstein in *Asplenites ottonis*, formerly described and illustrated by Berger (1832). A further *Lepidopteris*-flora containing 8 taxa has been listed from Kipfendorf (Fischer 1907, and most recently by Jung in Achilles 1981). This Rhaetian succession is overlain by marine Liassic beds (Bloos & Gräbenstein 1993). *Lepidopteris* cuticles have also been described from Theißenstein (Jung 1960).

All these localities lie closely together within an area approx. 10 km east of Coburg (Fig. 1). The Rhaetian age of the Kipfendorf macroflora has been confirmed by palynological investigations (Achilles 1981).

In 1993, one of us (K.-P. K) found some plant fossils in the sandstone quarry Heilgersdorf, near Sesslach, southwest of Coburg (Fig. 1). Further excavations yielded more plants, and in the summers of 1993 and 1994 more extensive collections were made.

## Geological setting

Intensive sedimentological and lithostratigraphical studies have already revealed that all sediments in the sandstone quarry of Heilgersdorf belong to the Rhaetian stage (Hoffmann 1970; Keßler 1973; Blankmeister 1989). The base of the quarry consists of several metres of sandstone. Noteworthy is the absence of the "Grüne Bank" (Hoffmann 1970) on top of the so-called "Rhät Hauptsandstein" in the Heilgersdorf site, a lithostratigraphical marker bed indicating saline diagenetic conditions. The "Rhät Hauptsandstein" is superposed by the "Rhät Hauptton" consisting of several layers of clay with some intercalated lenticular coal seams up to 15 cm thick, followed by a sandstone layer ("Oberer Sandstein"). The main plant bed is found in the basal "Hauptton" which is 1-2 m thick. Plant remains have also been found in the basal overlying sandstone, including *Lepidopteris*.

## Short description of the flora

As *Lepidopteris* is considered to be a guide fossil for the Rhaetian, the presence of this genus (Pl. 1, figs. 1, 2) both in the main plant bed, in the clay (where it is one of the most common species) and in the overlying sandstone, confirmed the conclusion of Keßler (1973), that this sediment sequence is of Rhaetian age. The specific determinations of the *Lepidopteris* material is not unequivocal: Apart from the singular occurrence of *L. brevipinnata* (Mägdefrau 1953), only two *Lepidopteris* species have been re-

corded from Germany and neighbouring countries such as Poland: the type species of the genus *L. stuttgardiensis* (-Jaeger, 1827) Schimper, 1869 recorded from near Stuttgart, and *L. ottonis* (Goeppert, 1836) Schimper, 1869. The latter species has also also been recorded from East Greenland (Harris 1932), Sweden (e.g. Antevs 1914; Lundblad 1950) and Poland (e.g. Barbacka 1991), as well as from parts of Germany including the neighbourhood of Coburg. All these authors have identified their material with *L. ottonis* rather than with *L. stuttgardiensis* because the latter species is less well known than the former one. The cuticle of *L. ottonis* is well known, while that of *L. stuttgardiensis* has never been described. The two species are very similar, their main difference being the shape of the pinnules and the roughness ("tubercles") of the rachis. *L. stuttgardiensis* has more linear and apically obtuse pinnules and a slightly rougher rachis than *L. ottonis* (Antevs 1914; Harris 1932). As these features may well fall within species variability, we believe that *L. stuttgardiensis* and *L. ottonis* are probably identical, in which case the type species *L. stuttgardiensis* has priority since it is the older species, and all material should be assigned to *L. stuttgardiensis*. This is, however, still subject to a more extensive study, not least because the cuticle of the material described here (Pl. 1, fig. 3) shows some slight differences with the cuticles of *L. ottonis* as described by Harris (1932) and Barbacka (1991).

Together with the *Lepidopteris* leaf material, male fructifications have been found (Pl. 1, fig. 6) that seem to be identical with *Antholithus zeilleri* Nathorst, the male fructification of *Lepidopteris ottonis* (Antevs 1914; Harris 1932). Also specimens of female *Peltasperum* fructifica-

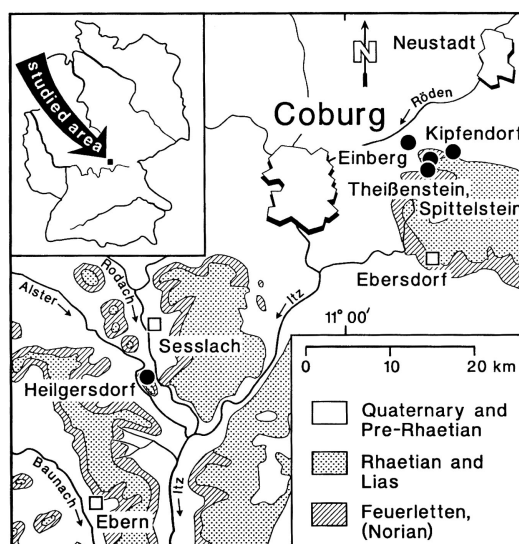


Figure 1  
Simplified geological map indicating the location of the Rhaetian macroplant localities in the neighbourhood of Coburg.

tions (Pl. 1, figs. 4, 5), probably belonging to *P. rotula* Harris, the seed-bearing organ of *L. ottonis* (Harris 1937) have been recovered from the Heilgersdorf locality.

Other plants that have been yielded from these beds include an *Equisetites* species, most probably *E. conicus* (Pl. 2, fig. 3) which occurs mainly in the overlying sandstone. The ferns are represented by one species of *Todites* and several *Cladophlebis* species. Additionally a small fragment of *Phlebopteris* was found and remains of *Rhizomopteris*. All these species are rather rare, in contrast to *Dictyophyllum acutilobum* which is present in large quantities both in the main plant bed and in the sandstone (Pl. 2, fig. 9).

Besides *Lepidopteris*, the pteridosperms are represented by a *Pachypteris* species with narrow leaflets, a thin lamina and a very thin cuticle (Pl. 2, fig. 1). The morphology of this material resembles, to some extent, that of *Pachypteris* (*Thinnfeldia*) *bellhofensis*, as described from the Liassic of the Bayreuth area. However, this preliminary determination must be confirmed by more extensive studies. Associated with it, and possibly belonging to it, is the fertile fructification *Umkomasia* (Pl. 2, fig. 8).

The cycads are represented by *Nilsonia polymorpha* Schenk (Pl. 2, fig. 6) which frequently occurs in both layers. This determination could be confirmed by the preparation of its cuticle (Pl. 2, fig. 5). A small fragment has been recovered that shows all characteristics of a *Pseudoctenis* pinna with a decurrent base and a venation without any anastomoses. It shows some similarity with *P. spectabilis* Harris from the Rhaetic of East Greenland (Harris 1932). Since the fragment is rather small and no cuticle was present, this determination cannot be confirmed, and we prefer to note the specimen as *Pseudoctenis* sp.

Material which was initially thought to be another *Nilsonia* species, proved on preparation of its rather thin cuticle, to belong to the Bennettitales. It is included in the genus *Pterophyllum* on the base of the shape of its pinnae, provisionally as *Pterophyllum* sp. (Pl. 2, fig. 4). So far, it has been impossible to identify it with any of the known *Pterophyllum* species. There is a possibility that it is a new species.

Several specimens have been found belonging to the form genus *Taeniopteris* (e.g. Pl. 1, fig. 7). There is a reasonable possibility that they may belong to the bennettitalean genus *Nilsoniopteris* when we have managed to prepare their cuticle. The sometimes forked venation, the shape of the petiole and the overall leaf morphology resemble *Nilsoniopteris* more closely than undivided *Nilsonia* leaves.

So far, only one ginkgoalean leaf fragment has been found; this is determined as *Ginkgoites* sp. on the basis of its leaf morphology with large leaf segments.

The conifers are represented by several genera and species. The species *Stachyotaxus elegans* Nathorst (Pl. 2, fig. 2) is also characteristic of the Rhaetic stage. Al-

though the determination could so far not be confirmed by the cuticle, we do not hesitate to assign our material to this species, because we have found a considerable amount of material and it agrees with *S. elegans* in all aspects. Other coniferalean leafy branches have been provisionally included in *Palissya* because they resemble *Palissya sphenolepis*, but as the typical *Palissya* cones have not been recovered so far, this determination is by no means certain.

Needle-like coniferalean leaves are abundant in every zone of the plant beds, indeed they sometimes cover entire specimens. On the base of their shape, they have been provisionally assigned to *Schizolepis liasokeuperianus* Braun (Pl. 2, fig. 7). One cone scale resembling a cone scale of this species was also found, but because of its poor preservation no definite assignment could be made. The last leaf species that should be mentioned is a *Desmiophyllum* species. *Desmiophyllum* is a form genus used for long and broad leaves with parallel venation. Their species can very well belong to different groups of plants; usually the affinities are unknown. The material found in this locality resembles *D. imhoffii* Florin, especially with respect to the strange internal structure known from this species. This characteristic structure (Kelber, 1990) has also been found here.

Apart from the pteridosperm fructifications mentioned above (*Antholithus*, *Peltaspermum* and *Umkomasia*), several male and female fructifications have been found together with various types of seeds. All this material deserves further study. Coal as well as fusain and permineralized wood have also been recovered.

In conclusion, it is reasonable to say that this flora is probably the richest, purely Rhaetic flora in northwest Europe after the Greenland and Swedish floras. It certainly contains species that are known from both of these two floras (e.g. *Lepidopteris* sp., *Stachyotaxus elegans*), as well as containing some species that are common in Liassic floras of Germany (*Schizolepis liasokeuperianus*). Additionally it very probably also contains species that are unique to this flora.

This flora is certainly the most diverse Rhaetic flora in the German basin. Extensive research in the next few years may reveal more species and will certainly give more information on the species discussed here.

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**Plant macrofossils from the Rhaetian of  
Heilgersdorf, Germany.**

Unless otherwise stated scale bars are 1 cm.

1

*Lepidopteris* sp., rachis with intercalary pinnules;  
HEI-027a.

2

*Lepidopteris* sp., portion of a frond; HEI-024.

3

*Lepidopteris* sp., cuticle of a pinnule; x 100, HEI-227a.

4

*Peltaspermum* sp., impression of a peltate head; HEI-135a.

5

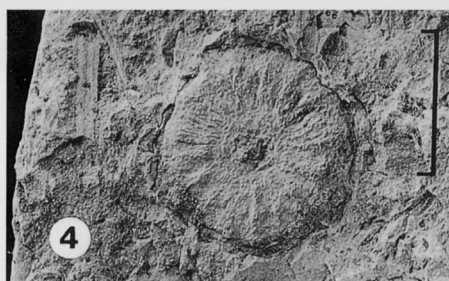
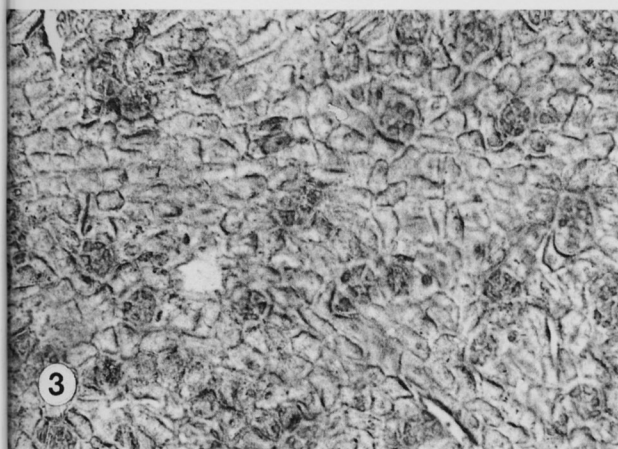
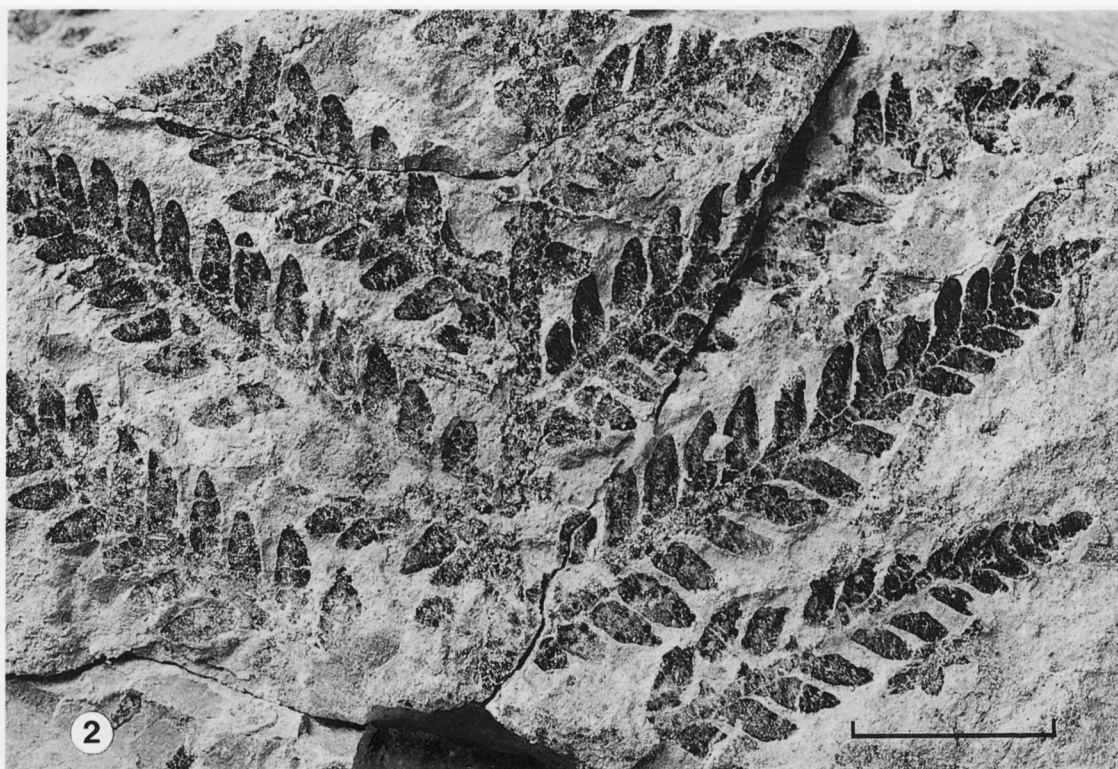
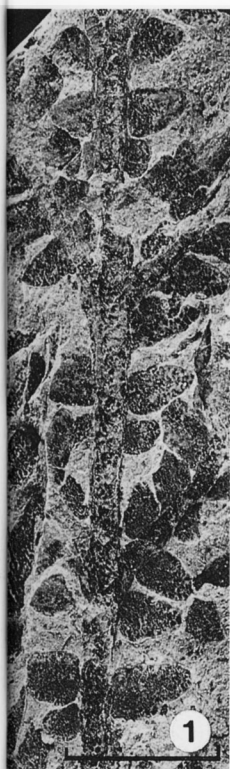
*Peltaspermum* sp., cluster of 3 peltate heads; HEI-028.

6

*Antholithus* sp., specimen showing pollensacks; HEI-165.

7

*Taeniopteris* sp., stalked leaf base; HEI-137a.



**Plant macrofossils from the Rhaetian of  
Heilgersdorf, Germany.**

Unless otherwise stated scale bars are 1 cm.

1

*Pachypteris* sp., portion of a frond; HEI-085.

2

*Stachyotaxus elegans*, leafy twig; HEI-082.

3

*Equisetites* sp., impression of a diaphragm with the basal  
leaf sheath; HEI-104.

4

*Pterophyllum* sp., part of a leaf; HEI-170.

5

*Nilsonia polymorpha*, cuticle, x 500; HEI-022.

6

*Nilsonia polymorpha*; leaf base; HEI-231.

7

*Schizolepis liasokeuperianus*, isolated leaves; HEI-206.

8

*Umkomasia* sp., portion of a strobilus; HEI-030.

9

*Dictyophyllum acutilobum*, pinna; HEI-169.



