SBORNÍK NÁRODNÍHO MUSEA v PRAZE
ACTA MUSEI NATIONALIS PRAGAE
Vol. I B (1938) No. 2. Geologia et Paleontologia No. 1

F. NĚMEJC:

Příspěvek k poznání svrchnokarbonských Archaeopteridů středních Čech.

Contribution to the knowledge of the Archaeopterides of the Upper Carboniferous in Central Bohemia.

(2 tab. a 5 obr. v textu)

(Předloženo 30. XI. 1937.)

Od roku 1928, kdy vyšel první díl mého spisu »Revise karbonské a permské květeny středočeských pánví uhelných«, obsahující rozbor a popis všech až do té doby u nás nalezených *Noeggerathií* a *Archaeopteridů*, nahromadilo se mi opět mnoho nového materiálu fosilního rostlinstva ze středočeských uhelných pánví. A tu jsem zjistil jednak některé exempláře, které mnohé již popsané fosilie činí mnohem jasnějšími, jednak některé rostlinné zbytky, které představují formy dosud nepopsané.

V citovaném díle uvedl jsem z našich středočeských uhelných pánví následující formy ze skupiny *Archaeopterides:*

Rhacopteris elegans ETT.
Rh. sarana BEYSCHL.
Rh. asplenites GUTB.
Rh. speciosa ETT.
Rh. postculmica KUŠTA.
Palaeopteridium reussi ETT.
P. macrophyllum NJC.
Triphyllopteris rhomboidea ETT.

K těmto formám třeba nyní na základě studia nového materiálu připsati ještě některé rhacopteridní formy a pak jmenovitě zástupce Schusterova rodu *Ulvopteris.*

Pokud se týče forem již dříve známých, třeba doplniti něco o rozšíření *Rh. postculmica* KUŠTA, který se zdál býti dle unikátního takřka Kuštova

nálezu velmi vzácný. Leč zatím jsem jej sám zjistil ve stropech II. sloje dolu Krimich v Nýřanech a botanický ústav Karlovy university získal pro své sbírky krásný exemplář ze Svinné u Radnic (stropy spodní radnické sloje). Tento poslední exemplář ukazuje dle úpravy (viz obr. v tekstu fig. 1.) a rozložení vějířků, že pravděpodobně šlo o vějíře dvakráte peřené, ač hlavní žebro není na exempláři zachováno.

Jako zcela novou formu uvádím zde *Rhacopteris bipinnata n. sp.* (viz obr. v tekstu fig. 4, 3), sbíraný jednak v Lubné u Rakovníka (opukové stropy sloje č. 1b dolů »Na Brantech«), z proplastu zv. Velká opuka »hlavní« sloje kladenských dolů a z brouskových pískovců mezi t. zv. mezislojí a slojí č. II. dolu Krimich II. v Tlučné. Jak patrno z vyobrazení a následujícího podrobného anglického popisu, jde o tvar stojící přibližně charakterem svých lístků mezi *Rh. elegans* a *postculmica*. Dle úpravy vějířků na vyobrazeném exempláři a dle jejich vzájemné polohy mám za to, že tento *Rhacopteris* byl také aspoň dvakráte peřený, ač hlavní žebro na nalezených kusech není přímo zachované.

Jako další *Rhacopteris* dlužno uvésti *Rh. linearis O. F.*, který byl popsán O. FEISTMANTELEM jako *Sphenopteris linearis* STBG. Se STERNBERGOVÝM typem nemá však nic společného, neb STERNBERGŮV *Sph. linearis* jest pouze část nějaké schizopteridní aphlebie, a to ještě dosti špatně zachované. FEISTMANTELŮV typ (viz Pl. II. fig. 2.) jest velmi podobný k *Rh. postculmica* KUŠTA. Pochází z radnických brousků (stropy spodní sloje).

Jest (— soudě dle originálního kusu —) vícekráte peřený a konce posledních vějířků jsou mnohem širší a daleko ne tak štíhle zakončené jako u *Rh. postculmica.*

Pokud se týče zmíněného SCHUSTEROVA rodu *Ulvopteris* (— popsaný původně ze saarské uhelné pánve —), tu dlužno se zmíniti, že vlastně jeho zástupce byl z našich uhelných pánví popsán O. Feistmantelem (1875/6) již mnohem dříve, než jej SCHUSTER definoval (1908), a to pod názvem *Neuropteris auriculata* BGT. Jelikož jak FEISTMANTELŮV originál (Pl. II. fig. 4.) tak obzvláště Schusterův kus jsou velmi neúplné, nelze zcela bezpečně říci, zda SCHUSTERŮV druh *U. ammonis* jest identickým s druhem FEISTMANTELOVÝM. Považuji to však téměř za jisté. *Ulvopteris* sám vzezřením svých lístků leží as tak uprostřed mezi tvary *Cardiopteridů* a tvary *Rhacopteridů*. Zbytky pocházející z našich pánví středočeských mají, obzvláště pokud se velikosti lístků týče, značně různé vzezření. Jsme skoro v pokušení říci, že jde o 2 druhy, leč přítomnost řady přechodů svědčí proti tomu. (Pl. II., fig. 7.) Mají totiž některé kusy laloky lístků značně štíhlé (způsob zachování k tomu ještě přispívá) (Pl. III. a obr. v tekstu 2, 5), jiné poměrně široce okrouhlé (Pl. II. fig. 3, 4, 5, 6). Dle některých kusů se zdá, jako by šlo o typ dvakráte peřený. A tu jest zajímavo, že ty otisky, které jeví lístky s laloky široce okrouhlými, mají zároveň vlastnosti, jaké nalézáme obyčejně na vějířkách vícekráte peřených listů ve špici, resp. blízko špice. Délka laločnatých lístků na novém bohatém materiálu, který daroval Nár. Museu z dolu Rako v Lubné u Rakovníka pan závodní F. Hlíza a který zaručeně pochází od

jediného rostlinného druhu, kolísá mezi 3 až 4 cm a 12 cm. Na starém musejním materiálu (— mezi který patří též FEISTMANTELŮV originál *Neuropteris auriculata* —), klesá délka dobře vyvinutých lístků až pouze na 2 cm. Lístky dlouhé mají vždy laloky štíhlejší. Pro tuto velkou variabilitu tvaru lístků nehodlám prozatím definovati na základě stávajícího materiálu více než jeden »druh«: *Ulvopteris auriculata* O. FEISTM. sp. Jeho naleziště náležejí vesměs pouze radnickým obzorům (Nýřany, Bílá Hora, Dibří, Zdejčina, Břasy, Rakovník a hlavně doly v okolí Lubné a Petrovic).

Seznam našich středočeských *Archaeopteridů* třeba tedy rozmnožiti o následující formy:

Rhacopteris bipinnata NJC.
Rhacopteris linearis O. FEISTMANTEL sp.
Ulvopteris auriculata O. FEISTM. sp.

Introduction.

In the first part of my monograph "A revision of the Carboniferous and Permian flora of the coal districts of Central Bohemia" (Palaeontographica Bohemiae. Nr. XII, 1928) I have discussed and figured all fossils from the Permocarboniferous of Central Bohemia, which on the bases of the material known at that time could be verified as representatives of the artificial group of the *Archaeopterides*. They were as follows:

Rhacopteris elegans ETT.
Rh. sarana BEYSCHL.
Rh. asplenites GUTB.
Rh. speciosa ETT.
Rh. postculmica KUŠTA.

Palaeopteridium Reussi ETT.
P. macrophyllum NJC.

Triphyllopteris rhomboidea ETT.

Since that time in the collections of the National Museum we have accumulated from various places of the Carboniferous of Bohemia new materials of fossil plants, which permit a more detailed knowledge of some of the species already described or the establishement of "species" untill present unknown.

In the following lines I wish to copmlete our knowledge about the Upper Carboniferous *Archaeopterides* based on the mentioned new collections.

1. On *Sphenopteris linearis* O. FEISTM. and *Sphenopteris linearis* STBG.

In the collections of the National Museum, Praha, are conserved both original specimens termed as *Sphenopteris linearis* by K. c. STERNBERG as well as by O. FEISTMANTEL. Both represent parts of fronds impressed in the known light coloured "Schleifsteine" rocks ("brousky" and "bělky"), which form the hanging wall of the Lower Radnice coal measure in the coal district of Radnice. At the first sight, we see that both specimens are parts of entirely different plant species.

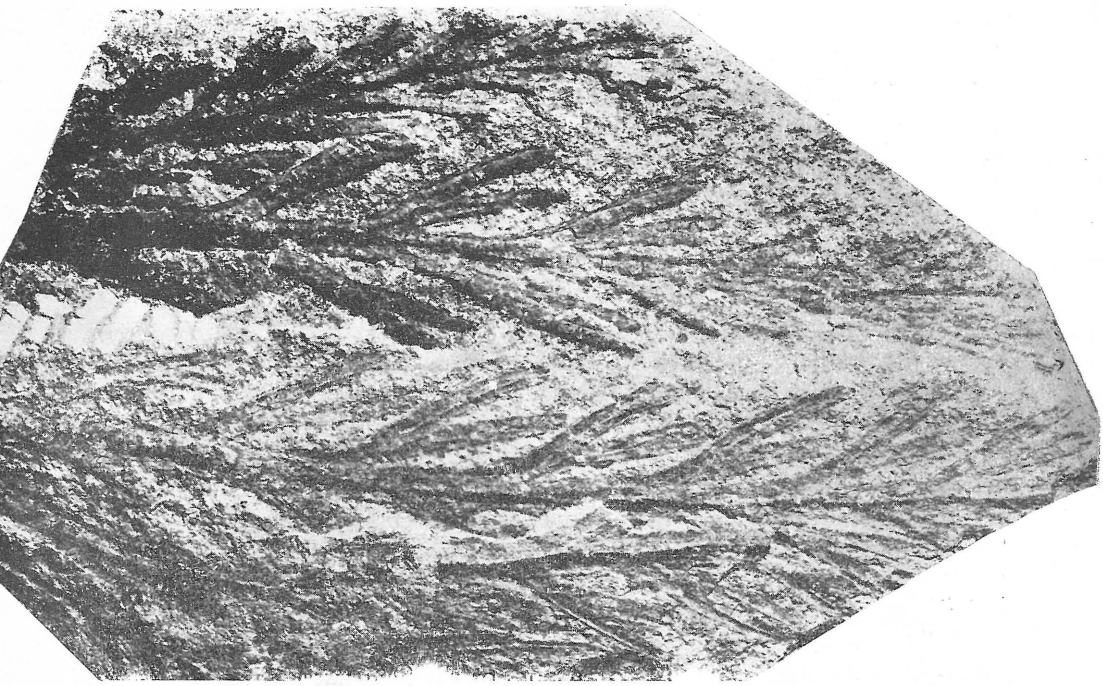
Sphenopteris linearis STBG. (Pl. II. fig. 1.) was figured by K. c. STERNBERG in his "Versuch einer geogn. bot. Darstellung d. Flora der Vorwelt" (Vol. 4, 1825, pp. XV. and Vol. 5/6, 1833, pp. 57. I. Pl. XLII, fig. 4), but somewhat schematically. The specimen in reality is very indistinctly preserved, especially the contours of the leaflets. Studying thoroughly the nervation, we see clearly, that this specimen represents only the top of a *Schizopteris* like aphlebia, very similar (— if perhaps not quite identical —) to the *Schizopteris* aphlebiae of *Dactylotheca plumosa Art.* STERNBERG's species might be by no means identified with that of BRONGNIART ("Histoire des végétaux fossiles". 1828, Pl. 54, fig. 1, pp. 175).

Sphenopteris linearis O. FEISTM. (Pl. II. fig. 2.) ist described and figured in O. FEISTMANTEL'S work "Die Versteinerungen der Steinkohlenformation in Böhmen« (Palaeontographica, Cassel, 1875/6, pp. 282, Pl. LXV, fig. 1). The original specimen is well enough preserved and aslo FEISTMANTEL'S figure is in the whole enough exact. The dividing of the nervation in this specimen is entirely different from that of STERNBERG'S species, but is similar to BRONGNIART'S species. But if we compare the shape of the leaflets and their lobes in both specimes (in that of FEISTMANTEL and that of BRONGNIART), we see, that FEISTMANTEL'S *Sph. linearis* is not to be identified with BRONGNIART'S *Sph. linearis.* The shape of the leaflets, the kind of their dividing into linear and one nerved laciniae, as well as the kind of joining of the leaflets to the rhachises is very similar to KUŠTA'S *Rhacopteris postculmica.* Though it seems according to the new finds, that *Rhacopteris postculmica* KUŠTA has been at least twice pinnate (— see further in the chapter 2. —), I am not inclined to identify FEISTMANTEL'S *Sph. linearis* with this "species", because in all specimens of *Rh. postculmica* the ends of the last pinnae are of a narrow lanceolate outline, whereas in *Sph. linearis* FEISTM. they are broadely rounded.

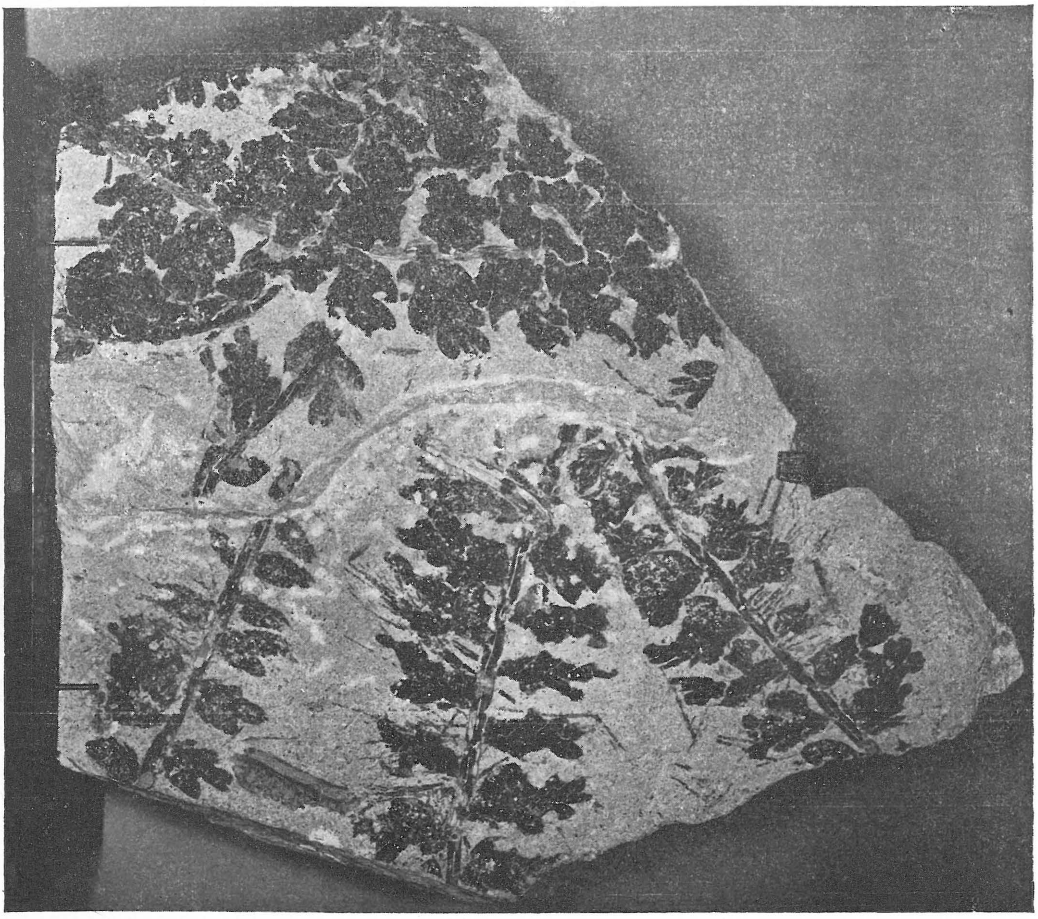
I suppose therefore, that FEISTMANTEL'S *Sphenopteris linearis* may be regarded as a further representative of the Upper Carboniferous *Rhacopte-*

Fig. 1. *Rhacopteris postculmica* KUŠTA. — 1/1 — Loc.: Svinná. — Coll.: Bot. inst. of the Charles University, Prague.

Fig. 2. *Ulvopteris auriculata* O. F. — 1/3 — Loc.: Lubná (mines »Rako«). — Coll.: Nat. Museum, Prague (leg. F. Hlíza).



1



2.

rides, as *Rhacopteris linearis* O. FEISTM. The arrangement of the imprints of the pinnae on the rock gives some evidence, that this form has been three times pinnate, though the main rhachis is not preserved on the slab.

2. Additional remarks to *Rhacopteris postculmica* KUŠTA.

Writing my monograph "Revision etc." I thought KUŠTA'S *Rhacopteris postculmica* to be a very rare rhacopteroid form of the Upper Carboniferous of the coal districts of Central Bohemia. I knew at that time only the original specimens of KUŠTA, which have been collected in the Radnice coal mesasure series at R a k o v n í k (— mine Moravia; shales of the "Schleifsteine" horizon between the Lower and the Upper Radnice coal measure —). Lately during my stratigraphical and floristical studies in the coal districts of N ý ř a n y (the coal basin of Plzeň), I found a small specimen in the hanging wall of the coal seam Nro II. (— the Upper Radnice coal measure —) of the mine Krimich I. Further a very beatiful specimen was gained for the collections of the botanical institution of the Charle's University (Textfig. 1). This last comes from the light yellowish sandstones of the Schleifsteine horizon (— in the hanging wall of the Lower Radnice coal measure —) at S v i n n á in the coal districts of R a d n i c e. Thus Rh. postculmica seems to have been spread throughout all coaldistricts from P l z e ň to K l a d n o within the Radnice coal measures, of course only scarcely. The last mentioned specimen from S v i n n á is very interesting from the morphological point of view. The shape and the kind of the arrangement of the pinnae on the slab, seem to attest, that this rhacopteroid form was not simply pinnate, but at least twice pinnate. Unfortunately the lowest parts of the pinnae and thus the presumed main rhachis also are not preserved on the slab.

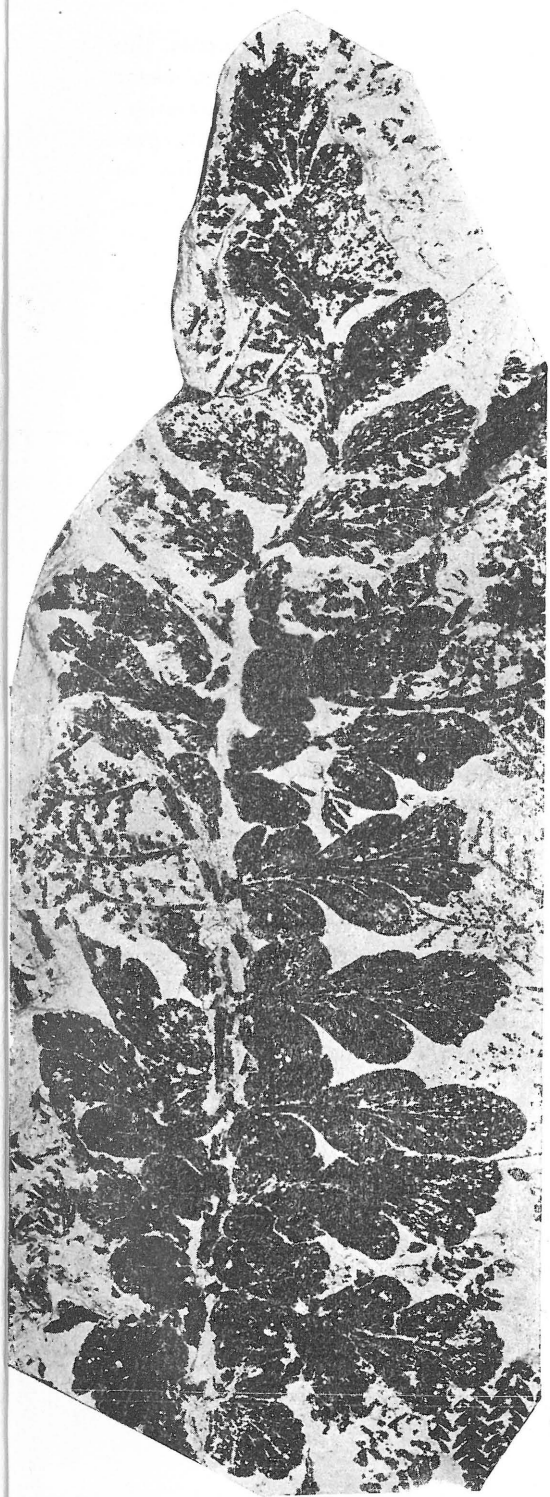
3. *Rhacopteris bipinnata* n. sp. (Textfig. 4, 3).

Among the lately collected fossils from the districts of K l a d n o, R a k o v n í k and N ý ř a n y, I found some rhacopteroid leaves, which are very similar to ETTINGSHAUSEN'S *Rhacopteris elegans*. But the kind of dividing of the leaflets is here far simpler than in ETTINGSHAUSEN'S species. In this respect our specimens are approaching somwhat to KUŠTA'S *Rhacopteris postculmica*, but differ essentially from that by their considerably assymetrical

Fig. 3. *Rhacopteris bipinnata* NIC. — 1/1 — Loc.: L u b n á (mines at »Branty«). — Coll.: Nat. Museum, Prague (leg. V. Treybal).

Fic. 4. *Rhacopteris bipinnata* NIC. — 1/1 — Loc.: N ý ř a n y (mine Krimich). — Coll.. Nat. Museum, Prague (leg. Ing. F. Freiberg).

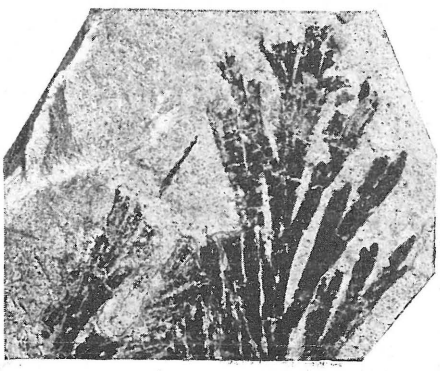
Fig. 5. *Ulvopteris auriculata* O. F. — 1/1 — Loc.: N ý ř a n y (mines at »Pankrác«). — Coll.: Geological inst. of the Charles University, Prague.



5.

3.

4.



shape. Untill present I know of this species only once pinnate fragments. But in one slab, which has been collected in the surroundings of Lubná (near Rakovník), the shape of the pinnae and the kind of their mutual arrangement, seem to attest a more compound character of the whole fronds; perhaps they have been twice pinnate. But unfortunately the lower portions of the pinnae and thus the presumed main rhachis also are not preserved, just as it was the case in the beautiful specimen of *Rh. postculmica* from Svinná. I figure this rhacopteroid form, which till now has not been described from our coal districts and which is not known to me from the foreign Carboniferous, under the name of *Rhacopteris bipinnata.*

4. On FEISTMANTEL'S *Neuropteris auriculata* and it's relations to SCHUSTER'S formgenus of *Ulvopteris.*

(Pl. II., fig. 3—7, Pl. III., Textfig. 2, 5.)

O. FEISTMANTEL figured in his "Die Versteinerungen der böhmischen Kohlenablagerungen" 1875/6 (Pl. LXVII, fig. 1, description see on pp. 277—288) under the name of *Neuropteris auriculata* a portion of the last pinna, the leaflets of which seem indeed to be of the same shape as in BRONGNIART'S *Neuropteris auriculata* (see A. BRONGNIART: "Histoire des végétaux *fossiles*" Pl. 66.). But O. FEISTMANTEL notes at the same time, that his specimen (— which was collected in the hanging shales of the Upper Radnice coal measure at Břasy —) is in some measure similar to certain species of the formgenus of *Cardiopteris*, especially to *Cardiopteris polymorpha* GOEPP. O. FEISTMANTEL knew his interesting "species" not only from the coal district of Radnice, but also from Lubná near Rakovník, as well as from Bílá Hora and Nýřany (Lazarus mines) in the surroundings of Plzeň.

In all the specimens, which were known to O. FEISTMANTEL, the leaflets have generally a neuropteroid or more or less cardiopteroid shape, 2—3 cm long; from both just named formgenuses they are distinguished by the character of their margin, which is slightly divided into 3 till 8 (— never more —) broadely rounded lobes. Since Feistmantel's times some new specimens of the same plant have been obtained for the collections of the N. Museum, partly from the same localities as FEISTMANTEL'S specimens, partly also from other places of our Carboniferous. Those new specimens show, that the variability of the shape of the leaflets is far stronger, than it would seem according to the old specimens. The length of their leaflets reaches more than 5 cm, but the number of their lobes remains always the same — only 8. The incisions between the lobes become deeper; the basal lobes are then relatively broad and rounded (especially the cathadrome one). The lobes of the upper portion of the leaflets are relatively narrow with rounded tops. All the lobes have always whole margins.

An especially interesting material of leaf impressions, similar to the greater specimens as just described, was presented to our Museum by F. Hlíza, the manager of the mine Rako at L u b n á (near Rakovník). These specimens come from the white kaolinic sandstones of the fireclay bed in the Lubná coal measure series. The greatest part of them shows generally lower or middle parts of the fronds, which all are only once pinnate (— just as in the formgenus of *Cardiopteris* or the greater part of the *Rhacopteris* —). The variability of the length of the leaflets is in the specimens of this locality far stronger: they measure from 3 cm to 12 cm, even more. But nevertheless the number of their lobes remains the same, only 8. Their shape is nearly the same as in the greater specimens of the material above described, except the lobes which are still longer.

At the first sight it would seem, that among the whole described material of leafimpressions we could define at least 2 various plant species. One with relatively small leaflets and broad rounded lobes, corresponding with the original specimen of O. FEISTMANTEL, and a second one with relatively great leaflets provided by narrow lobes. But, as mentioned, there are also many transition forms, which make such a presumption very unprobable. Therefore at present I am inclined to consider all the mentioned specimens for remains of one and the same plantspecies. The smaller forms, which correspond f. inst. with O. FEISTMANTEL's original specimen, seem to be always portions from the top of the once pinnate fronds. Specimens showing longer and narrower leafletlobes, are certainly middle ore lower parts of fronds.

The whole appearence of greater parts of the fronds is no doubt that of the *Cardiopterides, Sphenopteridia* or of the once pinnate *Rhacopterides.* The nervation of our specimens is somewhat similar to that of the *Neuropterides,* but also to that of the *Cardiopterides.* However it is not as dnse as in the *Cardiopterides,* by which it reminds more the nervation of the *Rhacopterides.* In the bibliography I found only one specimen figured, which may be compared with our fossil. It is *Ulvopteris ammonis* SCHUSTER (see: Julius Schuster »Zur Kenntnis der Flora der Saarbrücker Schichten und des pfälzischen Oberrotliegenden«. — Geognostische Jahreshefte 1907, XX Jahrg. München 1908. — pp. 184, Textbeilage K, fig. 2.). The specimen figured by Schuster is according to the relatively thick rhachis certainly a portion of the lover part of the whole frond. It shows only 2 entire leaflets and small parts of the 2 neighburing ones. They are very unconveniently preserved, their margin being partly indistinct. SCHUSTER describes the margin as being "crenulata vel subdenticulata". But his figure does not attest that; it points rather to the margin being entire if well preserved, just as in our specimens. Only the bad state of preservation causes that some parts of the impression seem to be like crenulated, or better to say like torn along the nerves (as f. inst. in the mesozoic *Nilssoniae* or the recent *Musa*). Therefore, I suppose that SCHUSTER'S *Ulvopteris ammonis* is identical with FEISTMANTEL's *Neuropteris auriculata,* representing a portion of the basal part of the frond. To become sure about that, it would be necessary to know some better preserved material

An especially interesting material of leaf impressions, similar to the greater specimens as just described, was presented to our Museum by F. Hlíza, the manager of the mine Rako at L u b n á (near Rakovník). These specimens come from the white kaolinic sandstones of the fireclay bed in the Lubná coal measure series. The greatest part of them shows generally lower or middle parts of the fronds, which all are only once pinnate (— just as in the formgenus of *Cardiopteris* or the greater part of the *Rhacopteris* —). The variability of the length of the leaflets is in the specimens of this locality far stronger: they measure from 3 cm to 12 cm, even more. But nevertheless the number of their lobes remains the same, only 8. Their shape is nearly the same as in the greater specimens of the material above described, except the lobes which are still longer.

At the first sight it would seem, that among the whole described material of leafimpressions we could define at least 2 various plant species. One with relatively small leaflets and broad rounded lobes, corresponding with the original specimen of O. FEISTMANTEL, and a second one with relatively great leaflets provided by narrow lobes. But, as mentioned, there are also many transition forms, which make such a presumption very unprobable. Therefore at present I am inclined to consider all the mentioned specimens for remains of one and the same plantspecies. The smaller forms, which correspond f. inst. with O. FEISTMANTEL's original specimen, seem to be always portions from the top of the once pinnate fronds. Specimens showing longer and narrower leafletlobes, are certainly middle ore lower parts of fronds.

The whole appearence of greater parts of the fronds is no doubt that of the *Cardiopterides, Sphenopteridia* or of the once pinnate *Rhacopterides.* The nervation of our specimens is somewhat similar to that of the *Neuropterides,* but also to that of the *Cardiopterides.* However it is not as dnse as in the *Cardiopterides,* by which it reminds more the nervation of the *Rhacopterides.* In the bibliography I found only one specimen figured, which may be compared with our fossil. It is *Ulvopteris ammonis* SCHUSTER (see: Julius Schuster »Zur Kenntnis der Flora der Saarbrücker Schichten und des pfälzischen Oberrotliegenden«. — Geognostische Jahreshefte 1907, XX Jahrg. München 1908. — pp. 184, Textbeilage K, fig. 2.). The specimen figured by Schuster is according to the relatively thick rhachis certainly a portion of the lover part of the whole frond. It shows only 2 entire leaflets and small parts of the 2 neighburing ones. They are very unconveniently preserved, their margin being partly indistinct. SCHUSTER describes the margin as being "crenulata vel subdenticulata". But his figure does not attest that; it points rather to the margin being entire if well preserved, just as in our specimens. Only the bad state of preservation causes that some parts of the impression seem to be like crenulated, or better to say like torn along the nerves (as f. inst. in the mesozoic *Nilssoniae* or the recent *Musa*). Therefore, I suppose that SCHUSTER'S *Ulvopteris ammonis* is identical with FEISTMANTEL's *Neuropteris auriculata,* representing a portion of the basal part of the frond. To become sure about that, it would be necessary to know some better preserved material

of *Ulvopteris ammonis* from the original SCHUSTER's locality (SCHUSTERs specimen was found at the mines of Dudweiler, on the tip of the mines at Gehlenberg).

Conclusion.

Studying some of the original specimens of O. FEISTMANTEL and K. c. STERNBERG and comparing them with newly obtained material of fossil plants in the collections of our National Museum (resp. also with some specimens conserved in the collections of the Charles University), I stated, that the plantimpressions cited previousely as *Sphenopteris linearis* and *Neuropteris auriculata* by O. FEISTMANTEL are representatives of the artificial group of the Archaeopterides. The first one is a *Rhacopteris*, the second one may be regarded as species of the formgenus of *Ulvopteris* SCHUSTER (very probably it is identical with SCHUSTER's species of *U. ammonis*).

Further I stated a new *Rhacopteris* form of our Upper Carboniferous, the *Rhacopteris bipinnata n. sp.*, which as to the shape of the leaflets stands between *Rh. elegans* ETT. and *Rh. postculmica* KUŠTA.

All the archaeopteroid forms described untill present from the Carboniferous of Central Bohemia may be found only in the Upper Westphalian series. One of them in the Westphalian D (Nýřany coal measures: *Rh. sarana*), the others in the Westphalian C (resp. transition into B) i. e. Lubná and Radnice coal measure series. In the whole we know at present from our Upper Carboniferous in Central Bohemia the following forms:

Rhacopteris elegans ETT.
Rh. sarana BEYSCHL.
Rh. asplenites GUTB.
Rh. speciosa ETT.
Rh. postculmica KUŠTA.
Rh. linearis O. FEISTM.
Rh. bipinnata NJC.

Palaeopteridium Reussi ETT.
P. macrophyllum NJC.

Triphyllopteris rhomboidea ETT.

Ulvopteris auriculata O. FEISTM.
(? = *U. ammonis* SCHUSTER.)

PLATE II.

Fig. 1. — "*Sphenopteris*" *linearis* STBG. — STERNBERG's original specimen (L. c. Vol. I., T. 42, fig. 4.) — 1/1 — Loc.: S v i n n á near Radnice.

Fig. 2. — "*Sphenopteris*" *linearis* O. FEISTM. — O. FEISTMANTEL's original specimen (L. c. T. 65, fig. 1.) — 1/1 — Loc.: R a d n i c e.

Fig. 4. — "*Neuropteris*" *auriculata* O. FEISTM. — O. FEISTMANTEL's original specimen (L. c. T. 67, fig. 1.) — 1/1 — Loc.: B ř a s y near Radnice.

Fig. 3. and 5. — *Ulvopteris auriculata* O. F.-Njc. — 1/1 — Loc.: Rakovník (leg. O. Feistmantel, 1870).

Fig. 6. — *Ulvopteris auriculata* O. F.-Njc. — 1/1 — Loc.: N ý ř a n y (mines et "Pankrác"; leg. Kolář).

Fig. 7. — *Ulvopteris auriculata* O. F.-Njc. — 1/1 — Loc.: R a d n i c e.

PLATE III.

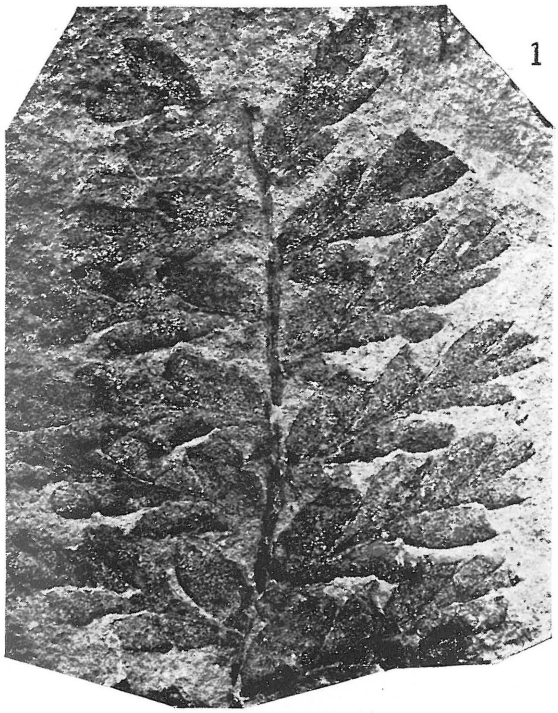
Ulvopteris auriculata O. F.-Njc. — Loc.: L u b n á, mines "Rako". — Leg.: F. Hlíza. — Fig. 1. — 1/2.

Fig. 2. a part of the foregoing specimen 1/1.

Fig. 3. and 4. — 1/1.

All specimens figured on Pl. I. and II. are conserved in the palaeobotanical collections of the National Museum, Prague.

Autor et F. Tvrz phot.



Autor et F. Tvrz phot.