

## ASPECTS OF ROMANIAN PALAEOZOIC PALAEOBOTANY AND PALYNOLOGY. PART I. AN *ACITHECA* TYPE FERN FROM SECU (BANAT)

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**Abstract.** Secu locality is one of the richest localities in Palaeozoic flora in Romania. The high preservation degree and the high diversity of the paleoflora make of Secu a future preserved site (SSSI – Site of Special Scientific Interest). The field work carried out during the last years on the sterile dumps of the Secu mine revealed a good amount of well preserved material belonging to a Marattialean fern with *Acithea* affinities. As defined, *Acithea* is a pecopterid foliage with synangia arranged on both sides of the pinnule midrib, each synangia including usually 4 to 8 more or less free sporangia. The material collected from Secu has strong similarities with *Acithea hemitelioides* but differs of it as it usually has 3 sporangia per synangium, instead of at least 4 in the case of *A. hemitelioides*. No in situ spores have been extracted yet but the potential of such findings is high enough for further analysis.

**Key words:** *Acithea* cf. *hemitelioides*, Upper Carboniferous, Filicopsida, Marattiales, Megafossils.

### INTRODUCTION

The Upper Palaeozoic (Westphalian B – Lower Permian) sediments of the Reșița Basin, Getic Nappe, yield a very rich and well-preserved flora known since the last century. They belong to the Reșița Formation (Bucur, 1991, 1997, Upper Carboniferous in age) and to the Ciudanovița Formation (Bucur, 1991, 1997, Lower Permian in age). Secu locality belongs to the Reșița Basin, it is confined to a local tectonic, marginal scale, and it is where a coal mine functioned till 1950. Secu occurs 7 km south-east of Reșița and it is the richest locality of the Reșița Basin (see a map in Popa, 1999), although only the former mine's sterile dump is the only place where plant fossils can be collected. The preservation quality and the diversity of this paleoflora makes of Secu a future Site of Special Scientific Interest (SSSI). The paleoflora of Secu is represented by species belonging to Arthropsidea, Lycopsida, Filicopsida, Pteridospermopsida and Cordaitopsida but the taxa list needs more revision and identification work. Recently, insect remains were collected as well.

The paleoflora of Secu was previously described in a series of short papers dealing generally with the Carboniferous deposits of the Reșița Basin. Bițoiianu (1973, 1976) gave the first detailed list of taxa from Secu, citing a

series of pecopterid species among which *Pecopteris hemitelioides* is present. Unfortunately, no description was given and the same happened with another work of Bițoiianu (1987), with the difference that in the later paper a series of paleocological considerations were given with regard to the paleoflora of Secu. Only one illustration of *P. hemitelioides* is given in Bițoiianu (1973). Also Bițoiianu (1974) identified the Stephanian A-C age in deposits outcropping at Esenovaț, Lupac, Lupacu Batrân, Stârcovaț and Birzăvița on an assemblage including *P. hemitelioides*.

### MATERIAL AND METHODS

The fossil material is compressive, represented by compressions and impressions and its preservation is exceptional. This preservation degree is an effect of the fine clays in which the material was caught, the highest preservation degree being reached when the clay is of porcelain nature. More than 230 hand specimens were collected from Secu and among them less than a half contain the species discussed here. The best, representative fragments of *Acithea* cf. *hemitelioides* are recorded on the hand specimens nos. P10/C2/149, P140/C2/229 A and B.

After being collected and recorded, the fossil material was studied using a Zeiss GSZ

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dissecting microscope, drew and photographed using a Praktika MTL 5B camera with wide angle lens and intermediary rings. For detailed photographs was used a Zeiss Stemi dissecting microscope with automatic camera.

### Systematics

Order MARATTIALES

Family Psaroniaceae STENZEL

Genus *Acithea* SCHIMPER 1879

This taxon was introduced for fertile *Pecopteris* material. A detailed discussion on the taxonomic status of genus *Acithea* was given by Lesnikowska and Galtier (1991). In this paper, the point of view of keeping *Acithea* as a valid taxon is shared with these authors. The separate status of this taxon is given mainly by the short central column that unites the sporangia within the same synangium (around one third on the total height of the sporangia) and by the fact that the sporangia are connected directly to the abaxial surface of the pinnule, being completely sessile. Lesnikowska and Galtier (1991) give also histologic data with regard to the separate status of *Acithea*, especially related to the structure and thickness of the sporangial walls but this approach was possible only on permineralized material. A separate taxon, but in fact very much related to *Acithea* is *Scoleopteris*, with more fused sporangia and pedicellate synangium, the latter character considered by Lesnikowska and Galtier (1991) as rather irrelevant as it depends on the position of the synangium within the pinnule. Another detailed discussion of *Scoleopteris* was given by Millay and Galtier (1990). *Asterotheca* and *Ptychocarpus* are also related genera, differing of *Acithea* by their longer inner column of the synangium and different attachment (Remy and Remy, 1959).

### *Acithea* cf. *hemitelioides* (BRONGNIART)

Text-Figures 1-4, Plate I, Figures 1-4

### Description

Frond fragments are represented by impaired-pinnate pinnae which are preserved usually with lengths not exceeding 90-100 mm. The rachis is stout, straight, finely striated longitudinally, with widths varying between 0.7-1 mm.

The pinnules are inserted to the upper part of the secondary rachis, oppositely or suboppositely, with lengths between 6-10 mm and widths between 2-3 mm. They have an elongated, rounded to rectangular shape in the middle parts of the pinnae and short-rounded, circular or irregular shapes to the terminal parts

of the pinnae (Plate I, Figure 3). The terminal pinnule is elongated-triangular, decurrent to the last pair of pinnules. The insertion of the pinnules is made with the entire base, lacking of any decurrent character, sometimes with a very slight base constriction (Text-Figures 1, 2; Plate I, Figures 1, 2, 4). Pinnules are almost perpendicular to the rachis, parallel, never overlapping. The margins are entire and parallel, converging very lately to the apex that is rounded. The adaxial surface of the pinnules is slightly waved due to the secondary veins (Plate I, Figure 1). The midrib is straight, not prominent, 0.4-0.5 mm in width, finely striated longitudinally and it is perpendicularly inserted to the rachis. It never reaches the apex, only after splitting in two secondary veins. The secondary veins are simple, never forking, they are inserted at angles between 45°-50° to the midrib, while the first, basal secondary veins are inserted directly to the rachis (Text-Figures 1, 2). Their density is of 2-3 veins per 1 mm. They always reach the pinnule's margins of the apex. Two types of secondary veins were recorded always alternating along the pinnule's length. The first type is more prominent abaxially and adaxially, it is thicker, never feeding synangia. The second type is thinner, always feeding the synangia. There are 12-15 pairs of thinner and thicker secondary veins along the pinnule's length. The abaxial surface of the pinnules, between the margins and the synangial rows is striated by the casts of the secondary veins, especially to the apical areas (Plate I, Figures 3, 4).

The synangia are distributed along two rows, on each side of the midrib, usually 8 synangia on each side of the midrib, along the pinnule, varying between 7 and 9 (Text-Figure 2). They are conical in shape, with a circular base, 0.8-1 mm in diameter. Each synangium contains three or rarely four sporangia arranged radiary. The sporangia are free, not united, being separated by a narrow, planar space going deep to their base (Text-Figures 3, 4). The central part of the synangium is hollow, more or less rounded, very deep, along three quarters of the total length of the sporangia, sometimes even deeper. On casts, these spaces and the central hollow generate convergent, radiary arranged walls at 120° angle in between (Plate I, Figure 4). The sporangia are smooth or finely striated longitudinally. No in situ spores were extracted yet.

### Discussion

The specific characters of this taxon are represented by the secondary veins and by the typical synangia having almost always three

sporangia and only rarely four per each structure. The sterile material resembles very well *Pecopteris hemitelioides*, in shape and venation, although the two different types of secondary veins that occur in the collected material is not typical for this taxon, as well as its size, which is slightly larger in the Romanian material than elsewhere. *P. hemitelioides* is a well-defined taxon, separated from other pecopterid species by clear characters: shape, midrib and secondary veins. Good descriptions and illustrations of this taxon, for sterile or fertile material, were given by Martin (1960), Laveine (1989) and Vetter (1968).

More difficult proves to be the comparison of the fertile material. The main difference between the fossils of Secu and those from abroad Romania is represented by the low number of sporangia (usually three and rarely four), against at least four for the foreign material. Also, the deep internal space between the sporangia, as well as the short height of the central column in the collected material is different from the same characters shown by *Acithea hemitelioides* from elsewhere.

These are the grounds on which the assignment of the Romanian material is given here as *Acithea* cf. *hemitelioides*, further studies following to confirm this species or to define a new species.

#### Occurrence and phytostратigraphy

The occurrence of this taxon was recorded till now only from Secu, where it is very abundant, from point P140/C2, which designates the sterile dump of the formed Secu mine, along the Secu Valley. In the Reșița Basin, *Pecopteris hemitelioides* was cited from Secu by Bițoianu (1976) and from Birzăvița, Lupac, Esenovaț and Lisava Mare Valleys, as well as from a borehole and from the Gallery

no. 2 from Lupac (Bițoianu, 1988). From the Sirinia Basin (Danubian Units), this taxon was identified from Baia Noua by Bițoianu (1966).

Abroad, *Pecopteris (Acithea) hemitelioides* was identified from Stephanian deposits of France, from Montceau-les-Mines (Langiaux, in Poplin and Heyler, 1994), Saint-Etienne (Doubinger *et al.*, 1995), La Mure (Martin, 1960), Southern Britain (Cleal, 1997), Sarre – Lorraine (Laveine, 1989, who cites it as an *Asterotheca*, even from the Westphalian D - Stephanian), Detroit and Rodez (Vetter, 1968). Doubinger *et al.* (1995) consider *Pecopteris hemitelioides* a cosmopolite species, ranging from Westphalian D to Lower Permian.

#### CONCLUSION

Exceptionally well preserved material assigned to *Acithea* cf. *hemitelioides* was collected from Secu locality, a future Site of Special Scientific Interest (SSSI). The porcelain type clay in which the material is preserved permitted the study of fertile and sterile structures that share features with *Acithea hemitelioides*, mainly as shape of pinnules and venation. The Romanian material slightly differs of this taxon by the low number of sporangia per synangium, of three, rarely four, and by their degree of freedom within the same structures, with a deep, lateral space between sporangia and a very short inner column. These aspects may indicate a new species as well as a particular type of *Acithea hemitelioides*.

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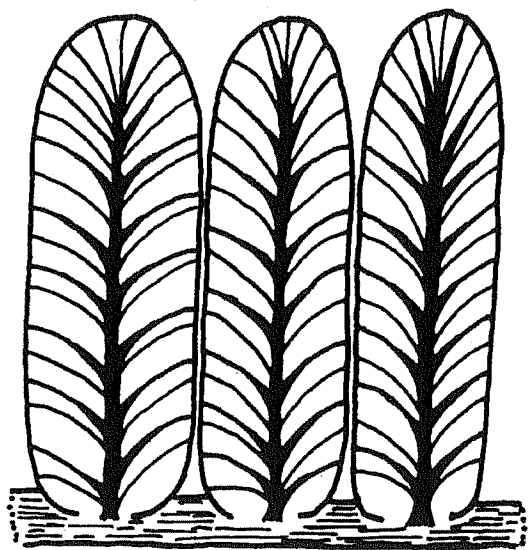
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#### CAPTION OF TEXT-FIGURES

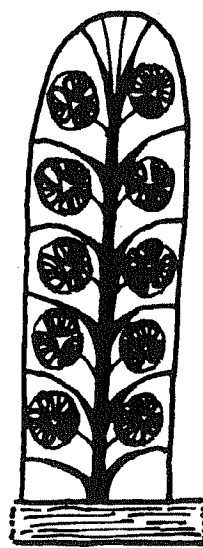
- Text-Figure 1. Adaxial view of *Acitheca* cf. *hemitelioides*. Pinnule size: 10 mm;
- Text-Figure 2. Abaxial view of fertile *Acitheca* cf. *hemitelioides*: synangial arrangement and structure. Pinnule size: 10 mm;
- Text-Figure 3. Synangium of *Acitheca* cf. *hemitelioides* in abaxial view: three conical sporangia. A-A' represents the section line of Text-Figure 4. External diameter 1 mm;
- Text-Figure 4. Section of *Acitheca* cf. *hemitelioides*' synangium showing free sporangia figured in Text-Figure 3.

#### CAPTION OF PLATE I

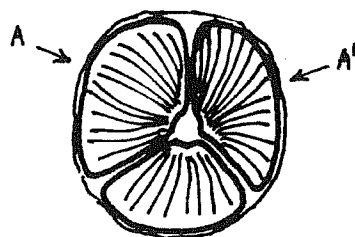
- Figure 1. *Acitheca* cf. *hemitelioides*, sample P140/C2/229B, adaxial view;
- Figure 2. *Acitheca* cf. *hemitelioides*, abaxial view of a terminal frond fragment;
- Figure 3. *Acitheca* cf. *hemitelioides*, sample P140/C2/229C, enlarged abaxial view of a terminal frond fragment;
- Figure 4. *Acitheca* cf. *hemitelioides*, enlarged abaxial view of a pinnule. All scale bars: 1 cm.



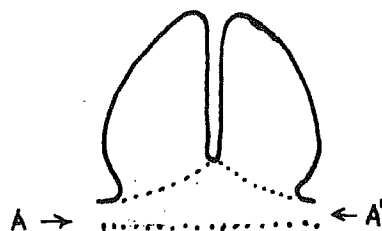
Text-Fig. 1



Text-Fig. 2



Text-Fig. 3



Text-Fig. 4

