ACTA PALAEONTOLOGICA ROMANIAE V. 6 (2008), P 279-286.

NEW SARMATIAN PLANT MACROREMAINS FROM OLTENIA REGION (ROMANIA). Part I

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Abstract: Three fossil floras are investigated based on leaf-, seed- and fruit remains from the Oltenia region (west of Dacian Basin, Romania) correlated to the Upper Badenian-Middle Sarmatian (Upper Miocene). The palaeobotanical determinations are based on morphological analyses. We describe some fossil taxa never found in Oltenia and few new discovered in Romania. It supplements the knowledge of the floristic composition of the Sarmatian deposits of Romania.

Keywords: Sarmatian, macroflora, Oltenia region, *Eostangeria*, *Berberis*, *Matudaea, Cedrelospermum*.

INTRODUCTION

Within the Oltenia region (Fig. 1), south-west Romania, occurs the famous Slătioara flora (Barbu 1942, 1954), the Ciocadia Valley marlstone flora (Țicleanu 1984, Paraschiv 2005, 2006 b) and the much new discovered Morilor Valley flora (Paraschiv 2004, 2006 a, b). This region exposes a sequence of a late Badenian to middle Sarmatian sediments and volcanogenic sediments with special interest in fossil plants. The Slătioara and Ciocadia Valley plants (Fig. 2) are all exceptionally preserved as imprints and compressions in marlstones of Upper Badenian-Sarmatian age (Barbu 1954; Țicleanu 1984; Givulescu 1999). From the plant assemblage of Morilor Valley (Mehedinți district, Fig. 2) the outcrops bear numerous vegetal fragments preserved in silty and clayey, well-bedded sediments, grey marlstone strata, volcanic tuffs, and thick siliceous sandstones, all of this lithological complex being of Lower-Middle Sarmatian age (Marinescu 1978).

Recent work in the north and south-west of Oltenia region has enabled the discovery of several other plant-taxa. Some of this new species are of particular significance because, it rise the diversity of fossil assemblages and few are markedly different from other plant-species recognized till now in Romania.

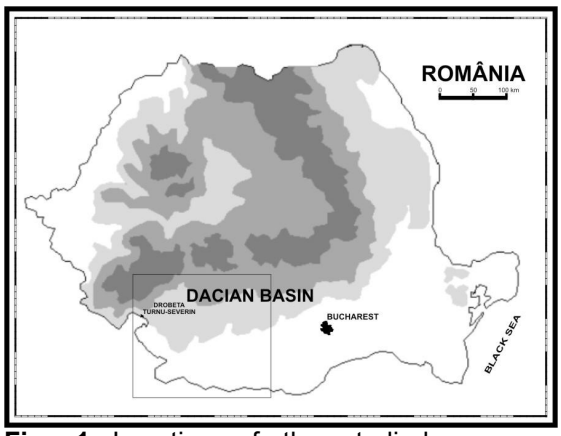

Fig. 1 Location of the studied area on Romania´s map.

METHODS

The geology and sedimentology of the Morilor Valley section was interpreted by using previous works which made investigations mapping the area in detail (Marinescu 1978; Huică 1994) and logging a number of key plant-bearing outcrops. Samples were taken from all levels that were found to preserve plant remains. The quality of preservation of these floras is high. A matrix of organic debris, rich in plant fragments, is presented and often represent large surfaces inside marlstone or siltstone beds. The systematic part is restricted to taxa previously unknown from Oltenia region or rare for the Romanian´s palaeoflora.

SYSTEMATIC PALAEOBOTANY

Phylum Rhodophycota
Class Rhodophytae

Genus *Ceramium* Roth 1797

Ceramium sp.
Pl. I, fig. 1.

Florideae?, Pop E. 1936, p. 16, Pl. II, fig. 1.

Description: Impressions of colonial red algal thalli with filamentous morphology (tubular tissue), composed by a tubular axis with numerous strangulations; each strangulation have branched lateral tufts and plumes which present secondary dichotomic ramifications.
Occurence in Romania: Morilor Valley (Mehedinți district) - Volhinian to lower Bessarabian (Sarmatian) age, Borsec (Harghita district) – Pliocene age.

Phylum Equisetophyta B. Boivin syn. Sphenophyta 1956.
Order Equisetales Dumortier 1829.
Family Equisetaceae Michx. ex DC. 1804.

Genus *Equisetum* Linnaeus 1753.

Equisetum sp.1, fertile stems
Pl. I, fig. 2.

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Equisetum sp., Ţicleanu 1995, p. 475, Pl. I, fig. 2.
Equisetum cf. *maximum* Lam., Ţicleanu & Paraschiv 2001, p. 363, Pl. IV, fig. 2.

Description: Fertile articulated stem with the fertile strobile incomplete and disposed at the distal part of the internode. The fertile stem is up to ?77 mm long, 4 mm wide, and have internodes; the fertile strobile is 7 mm wide.
Occurence in Romania: Slătioara (Vâlcea district) – upper Badenian to lower Sarmatian age, Lugoj Basin – middle Pontian = Portaferrian age), Brăneşti.

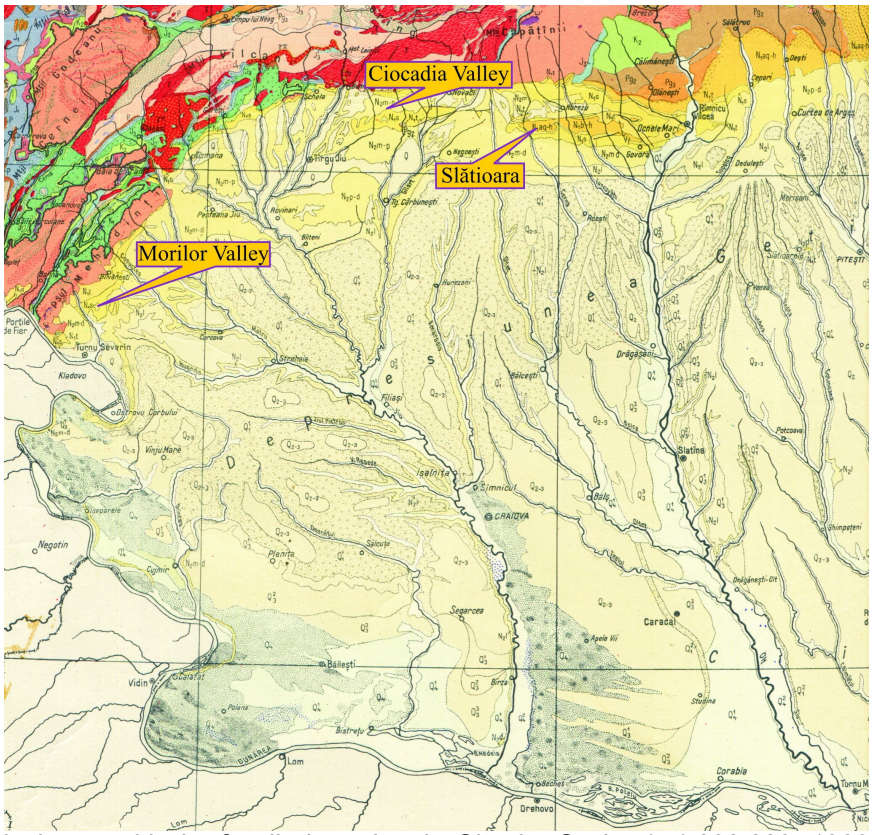

Fig. 2 Geological map with the fossil plant sites in Oltenia. Scale: 1: 1.000.000, 1966, made by the Geological Institute of Romania, Bucharest.

Order Polypodiales Mett. ex A.B. Frank in Leunis, 1453, 1458, 1877.
Family Polypodiaceae Bercht. & J. Presl 1820.

Genus *Pteridium* Gled. ex Scop. 1760.

Pteridium crenatum (Weber) Vahrameev
Pl. I, fig. 3.

Pteridium crenatum (Weber) Vahrameev, Petrescu 1969, p. 54, Pl. I, fig. l, m, n.

Description: Fragments of fronds, simply pinnate, pinnae undivided or irregularly lobed with semicircular shapes and attached to the axis with the whole basis. Pinnulae are sesile, opposite with numerous thin secondary veins radiating from a strong mid-vein.
Remarks: The nearest living relatives is considered *Pteridium aquilinum* (Linnaeus) Kuhn, which grew in moorland habitats and is sufficiently shade tolerant to survive in light spots in old growth forests.
Occurence in Romania: Morilor Valley (Mehedinţi district) - Volhinian to lower Bessarabian (Sarmatian) age, Jiu Valley (Hunedoara district) – Oligocene age.

Phylum Pinophyta Cronquist syn. Coniferophyta, 1996.
Class Cycadopsida Brongniart 1843
Order Cycadales Dumortier 1829
Family Zamiaceae Horan. 1834

Genus *Eostangeria* Barthel

Eostangeria cf. *ruzinciniana* (Palamarev, Petkova et Uzunova, 1975) Palamarev & Uzunova, 1992
Pl. I, fig. 4.

Angiopteris ruzinciniana Palam., Petkova et Usunova, 1975, Palamarev, Petkova et Usunova,

1975, p. 25-29, Text-fig. 1-3, Pl. I, fig. 1, Pl. II, fig. 1-3.
Angiopteris ruzinciniana Palam., Petkova et Usunova, 1975, Palamarev & Petkova, 1987, p. 14, Pl. III, fig. 1-5.
Eostangeria cf. *ruzinciniana* (Palamarev, Petkova et Uzunova, 1975) Palamarev & Uzunova, 1992, Jechorek & Kovar-Eder, 2004, p. 328-329, Pl. I, fig. 7, Pl. II, fig. 1, 2.

Description: Fragment of a once-pinnately compound leaf of ?34 mm length and 15 mm wide. The leaf is fern-like, conduplicated (folded together lengthwise, usually in two equal halves), with dense pinnate veins and an irregularly incised margin. The midvein is strong and straigth, secondary veins are longitudinally parallel, angle of departure from midvein being 15-25°. These secondary veins are densely spatiated, open at the pinna margin being ramified dichotomous and running into acuminate tooth. The dichotomizing veins is a character considered to be primitive.
Remarks: *Eostangeria* is a Paleogene relict finded rarely in the Miocene deposits. Now is cited for the first time in Romania. The nearest living relatives are considered two extant genera: *Chigua* D.W. Stevenson 1990 (Polypodiopsida, Zamiaceae) and *Stangeria* T. Moore 1853 (Cycadopsida).
Occurence in Romania and Europe: Ciocadia Valley (Gorj district) – upper Badenian to lower Sarmatian age, Weingraben (Austria, Burgenland, Badenian age), Ruzinci-Krivodol (Bulgaria, Volhinian age).

Order Berberidales Dumortier 1829.
Family Berberidaceae Jussieu 1789.

Genus *Berberis* Linnaeus 1753.

Berberis andreanszkyi Z. Kvacek & Erdei, 2001 (= *Lomatites aquensis* auct., non Saporta).
Pl. II, fig. 5.

Berberis andreanszkyi Z. Kvacek & Erdei, 2001, Z. Kvacek & Erdei, 2001, p. 2-3, Text-fig. 1, n. a-f.

Description: Leaves lanceolate, ?49 mm long and 9 mm wide showing an xeromorphic aspect. The bases is cuneate and the petiole is long (6 mm) and very strong. The lamina is widely simple acuminate and venation semicraspedodromous, midvein straight, thick, secondary veins run apart under 30-60° looping obliquely to subparallel along the margin. This generate a characteristic nearly continuous intramarginal vein. Tertiary veins join together the secondary loops and the marginal teeth.
Remarks: The nearest living relatives are species of Berberidaceae from east Asia (section Wallichianae Schneider) e.g. *Berberis soulieana* Schneider, *B. triacanthophora* Fedde, *B. veitschii* Schneider and *B. gagnepainii* Schneider.
Occurence in Romania and Europe: Morilor Valley (Mehedinți district) - Volhinian to Lower Bessarabian (Sarmatian) age, Erdobenye (Hungary, Middle Miocene), Eger/Wind brickyard (Hungary, Upper Oligocene).

Order Hamamelidales Griseb. 1854.
Family Hamamelidaceae R. Br. in Abel 1818.

Genus *Matudaea* Lundell 1940.

Matudaea menzelii Walther 1978
Pl. II, fig. 6.

Matudaea menzelii Walther 1978, Walther 1980, p. 498-516, Pl. I, fig. 1-6, Pl. II, fig. 3, 4.

Description: Lanceolate leaves to oval-lanceolate of 58 mm length and ?36 mm wide, laurophyl like, entire margined, with asymmetric rounded base, slightly decurrent and acuminate apex. Long and thick petiolated (21 mm /2.5 mm), narrowing to the base of the lamina. The venation is acrodromous, mivein straigth and strong which run into the apex teeth. Two secondary basal-laterally veins run like arches parallel with the margin and anastomosing in the apex area. There are present also 1-2 pairs of secondary veins in the upper part of the lamina. Tertiary veins run perpendicularly, percurrent (running through the entire length of a half lamina) on the mivein, are very thin and generate a poligonal-elongate network. Quaternary veins reticulate form typical regulate polygons.
Remarks: *Matudaea menzelii* seems to be an important and rare accessory taxa of the subtropical Evergreen Broad-leaved Forest formation from Central Europe during Neogene. Today living genus *Matudaea* Lundell is neotropical and stated as a threatened plant in the red list of IUCN (The World Conservation Union). It grew in the virgin forests from Central America (Mexico, Guatemala, Honduras and Nicaragua).
The nearest living relatives are *Matudaea trinervia* Lundell and *Matudaea hirsuta* Lundell, from relict areas of montane rain forests and *Pinus-Quercus-Liquidambar* type forests of Mexico. These two sempervirescent species vegetates at high altitudes of 900 - 2200 meters.

Occurence in Romania and Europe: Morilor Valley (Mehedinți district) - Volhinian to Lower Bessarabian (Sarmatian) age, Weißelster Basin (Germany, Leipzig, Haselbach Series, in the basal part of the Middle Oligocene)

Order Urticales Dumortier 1829.
Family Ulmaceae Mirbel 1815, nom. cons.

Genus *Cedrelospermum* Saporta 1862, emend. Manchester 1989.

Cedrelospermum sp. 1 fructus nov. sp., Paraschiv & Sebe 2008.
Pl. II, fig. 7.

Locus typicus: Romania, Gorj district, Bengeşti-Ciocadia commune, Ciocadia village, Ciocadia Valley.
Stratum typicum: Middle-Upper Miocene deposits, Upper Badenian-Lower Sarmatian.
Diagnosis: fossil fruit of samaras type, with the endocarpus (the seed) of oval-ellipsoidal shape, oblate; laterally conspicuous wing, asymmetrical; the venation shows 5 to 9 sub-parallel veinlets, including also one pair of marginal veinlets which converged toward the stigmatic area, located at the distal part of the wing.
Biometric data: the fruit has 16.5 mm length and 6 mm width; the seed length is 7 mm and the width is 4.5 mm.

Cedrelospermum sp. 2 fructus nov. sp., Paraschiv & Sebe 2008.
Pl. II, fig. 8 a.

Locus typicus: Romania, Mehedinți district, Bobaița commune, Colibaşi village, Morilor Valley.
Stratum typicum: The Morilor Valley Formation, Sarmatian, Volhinian-Middle Bessarabian.
Diagnosis: fruit of samara type, 20 mm long and 6 mm wide, having a particular venation of the wing: 6 longitudinal and sub-parallel veinlets, asymmetrically disposed. The seed is sub-parallel disposed on the wing and its dimensions are: 10 mm long and 3.5 mm wide.
Remarks: The extinct genus *Cedrelospermum* is represented by fossil plant remains (winged fruits and leaves), mostly described from the Cainozoic deposits of Europe, Central and North America.

We are maintaining the denomination *Cedrelospermum* as sp.1 and sp.2 because there weren't found more than these two specimens described above.
Occurence in Romania and Europe: Andreanszky & Mészáros 1959 described and figured at p. 303, Text-fig. 1, the species *Embothrites borealis* Unger from Leghia, Cluj district, the Jegenye fossiliferous site, from deposits of ?Middle Eocene age. The same taxon is treated by Givulescu 1960.

Iamandei 2004 identified the species *Cedrelospermum lineatum* (Lesquereux) Manchester in the Upper Maastrichtian deposits of Gurasada – Țiganului Valley (p. 205). We are considering now that this determination is uncertain because this denomination concerns a winged fossil fruit which must present two different wings, one primary, well developed and, the secondary one, very small attached on the posterior part of the seed. Moreover, this fossil species had a restrictive geographical area (only on the American continent).

According to Hably & Thiebaut 2002 *Cedrelospermum* was a component of the sclerophyl vegetation during the Oligocene and lately, in the Miocene of Europe, it developed in the mesophyl vegetation belt, producing bigger fruits than before. In the North America and also in Europe (according Manchester 1999), the smallest winged fruits (5-7 mm) had been discovered in the oldest locality, while the largest winged fruits had been identified in the youngest sites.

Such conclusions can be applied also to our two „species" of *Cedrelospermum* found in the Middle-Upper Miocene deposits from Oltenia, which have bigger dimensions than the older fruits from France, Germany or Hungary. In order of the increasing dimension of the fruits (during progressive time evolution) we can enumerate the following fossil-bearing sites: Aix-en-Provence, Céreste, Manosque, Randecker Maar, Magyaregregy, Ciocadia and the Morilor Valley.

CONCLUSIONS

The floristic diversity of the Sarmatian deposits of Oltenia region can yet support new records. After systematic exploitation of three fossiliferous sites we are able to bring into records inedite specimens of plants. *Ceramium* was never found up till now in the Sarmatian deposits of Romania. The high number of thallus impressions spread over large layer surfaces suggests extensive development of a quiet biotope in warm low deep marine waters. *Equisetum* and *Pteridium* are very rare taxa finded in the fossil flora of Romania. *Eostangeria* represents an extinct taxa with unclear systematic position, finded in few Upper Miocene deposits of Europe. *Berberis andreanszkyi*, discovered in aboundance in the Oligocene and Miocene

deposits of Hungary seems to migrate toward south-east, from the Pannonian Basin to the Dacian Basin were it can be the last appearance. *Matudaea*, an exotic taxa, finded up till now only in the Oligocene deposits of Germany do not have yet a precise route of migration. The western part of the Dacian Basin can be a shelter zone were this species survive until Upper Miocene. Due to the gross morphological similarity of the *Matudaea* with the *Daphnogene* sp. is possible that some specimen of the last one to be misidentified. So far we don't have enough clear facts about the region of origin where from *Matudaea menzelii* spread over Europe. Up till now *Cedrelospermum* was identified in Romania only as winged fruit remains, and represents the easternmost evidence of it's fossil areal. It appeared earlier in the North America and Western Europe were from it migrated through the east. Toward the east, the *Cedrelospermum* presents unequivocal evidence of producing bigger winged fruits. In the Morilor Valley site we report the youngest record of it from Europe. The presence of these two new specimens of *Cedrelospermum* in the Miocene deposits of Oltenia is enlarging the palaeogeographical area of distribution of the taxa and also is extending their survival time.

ACKNOWLEDGEMENTS

This work represents a contribution to the research of the Miocene floras from Romania, opportunity to express our sincere thanks to the National University Research Council (NURC) for financing the project „*Major climatic fluctuations in the Miocene of Romania: palaeobotanical proves*“, included in the program IDEI, cod ID_442, no. of contract 337/01.10.2007.

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PLATE I

Pl. I, fig. 1. - *Ceramium* sp.
Pl. I, fig. 2. - *Equisetum* sp.1, fertile stems
Pl. I, fig. 3. - *Pteridium crenatum* (Weber) Vahrameev
Pl. I, fig. 4. - *Eostangeria* cf. *ruzinciniana* (Palamarev, Petkova et Uzunova, 1975) Palamarev & Uzunova, 1992

Scale in mm

PLATE II

Pl. II, fig. 5. - *Berberis andreanszkyi* Z. Kvacek & Erdei, 2001 (= *Lomatites aquensis* auct., non Saporta).
Pl. II, fig. 6. - *Matudaea menzelii* Walther 1978
Pl. II, fig. 7. - *Cedrelospermum* sp. 1 fructus nov. sp., Paraschiv & Sebe 2008
Pl. II, fig. 8 a. - *Cedrelospermum* sp. 2 fructus nov. sp., Paraschiv & Sebe 2008
Pl. II, fig. 8 b. - *Pinus parvinucula* Saporta

Scale in mm

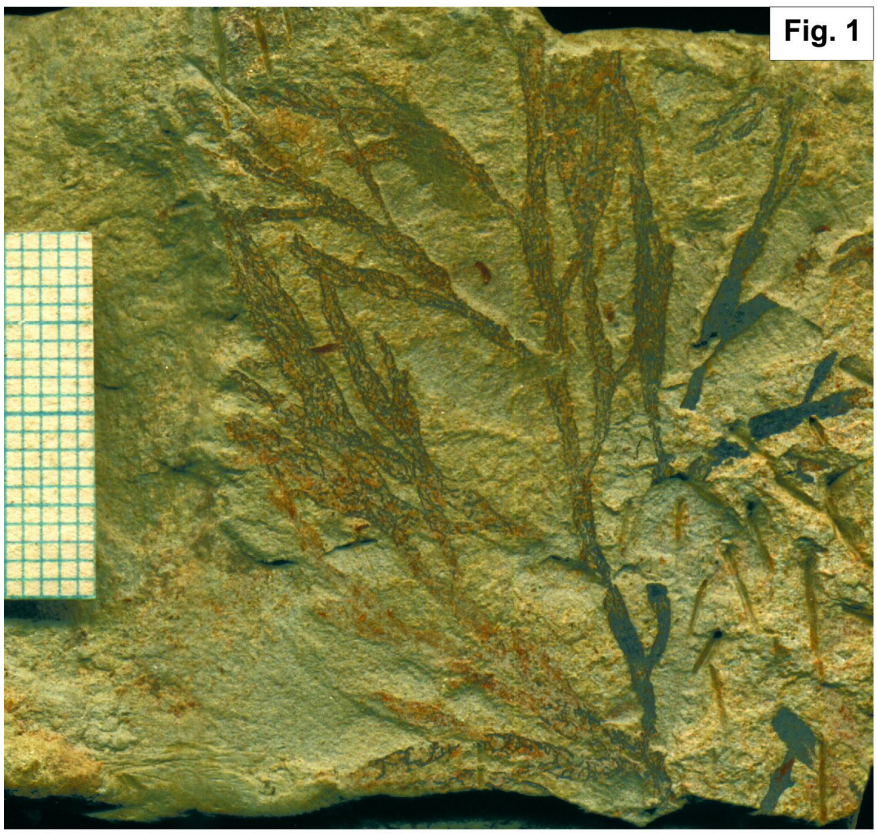


Fig. 1


Fig. 2

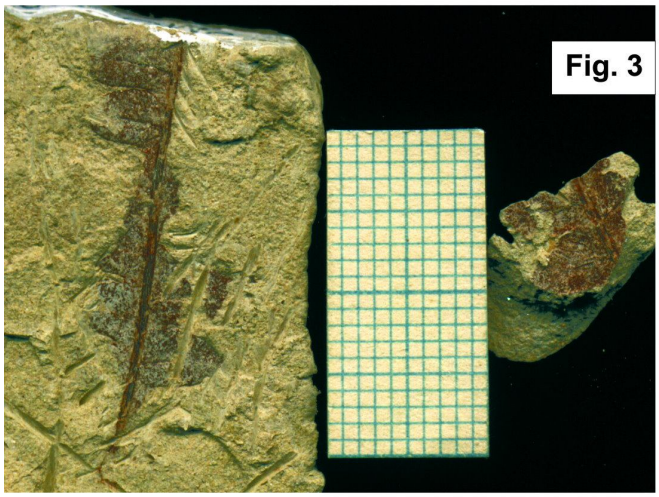
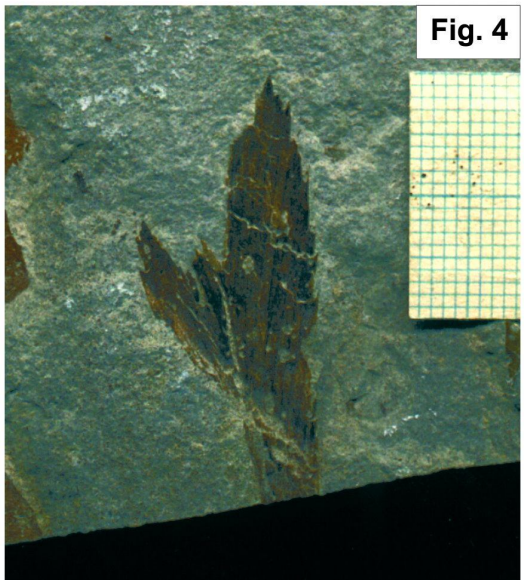


Fig. 3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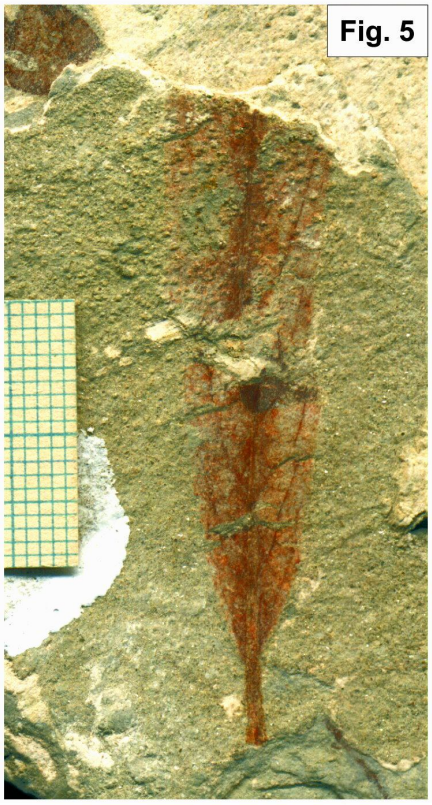
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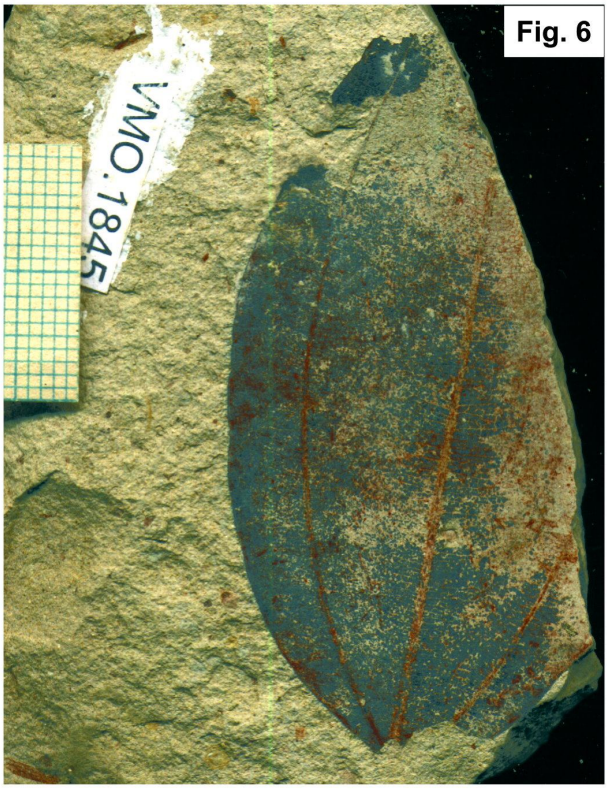

Fig. 6

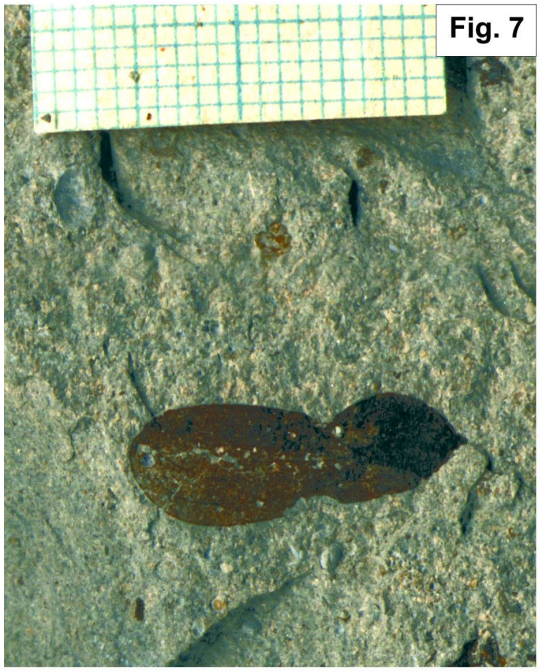
Fig. 7

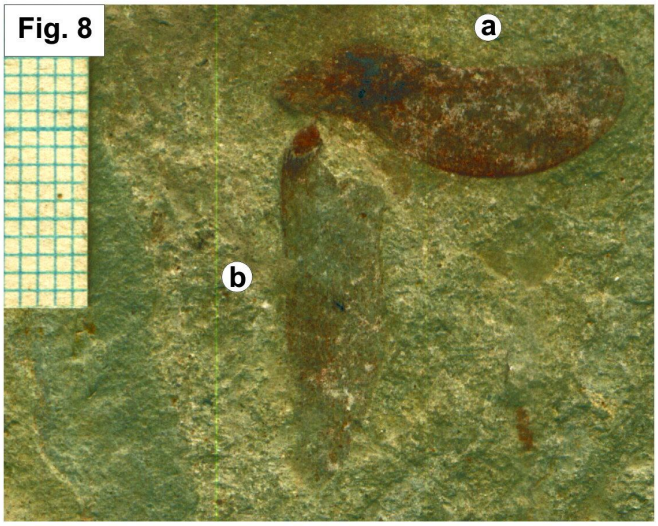

Fig. 8