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RECEAPHYLLUM GRANDIS CZIER G. ET SP. NOV. FROM THE LOWER JURASSIC OF ROMANIA

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Abstract. A new Spermatophyte genus and species *Receaphyllum grandis* Czier is proposed. The material originates from the fireclay mine at Recea quarry, western Romania, from the Lower Jurassic (Hettangian *pro parte* – Lower Sinemurian) Recea Member of the Șuncuiuș Formation. It was formerly erroneously assigned to *Pseudoctenis latus*. However, new investigations indicate that the characters do not allow assignment to this species, nor to this genus or to other genera hitherto known. The *Pseudoctenis* material from Romania and Hungary is critically reviewed, and taxonomic considerations on the species *P. herriesii* from the United Kingdom and *P. prossii* from Germany are noted. *Receaphyllum* is an autochthonous European genus; *R. grandis* is an endemic species.

Keywords. *Receaphyllum*, Spermatophyta, Romania.

Introduction

Although geological data from the Lower Jurassic fireclays of the Pădurea Craiului Mountains (part of the Carpathians in west Romania) have been available from the nineteenth Century, details of the fossil flora date only from the second half of the twentieth Century. Early geological studies of the ‘King’s Forest’ (Hauer 1852; Wolf 1863; Mátyásovszky 1884) contain no references to fossil plants. The first specimens of these were collected within the Șuncuiuș mining area, from fireclays in the Dumbrava, Recea and Banlaca mines. Dr Alexandru Semaka, the late palaeobotanist of the Institute of Geology in Bucharest, published studies of them. The collection sites are no longer accessible because the mines are closed.

Few studies of this flora have been published. Antonescu (1973) described the microflora but made no reference to the detailed stratigraphy or to the exact collection sites. Before his death, Semaka (1969, 1971) published two papers on the macroflora. Since 1986 I have continued this research following the discovery of fossil plants in the last underground working face before its closure.

Opportunities for collecting plant fossils improved enormously with the opening of open-cast mining in Recea quarry in 1987. These fossils were described by Czier and Popescu (1988), Givulescu and Czier (1990) and Czier (1989, 1994, 1995, 1997, 1998, 2000a, 2003). Figure 1 shows the

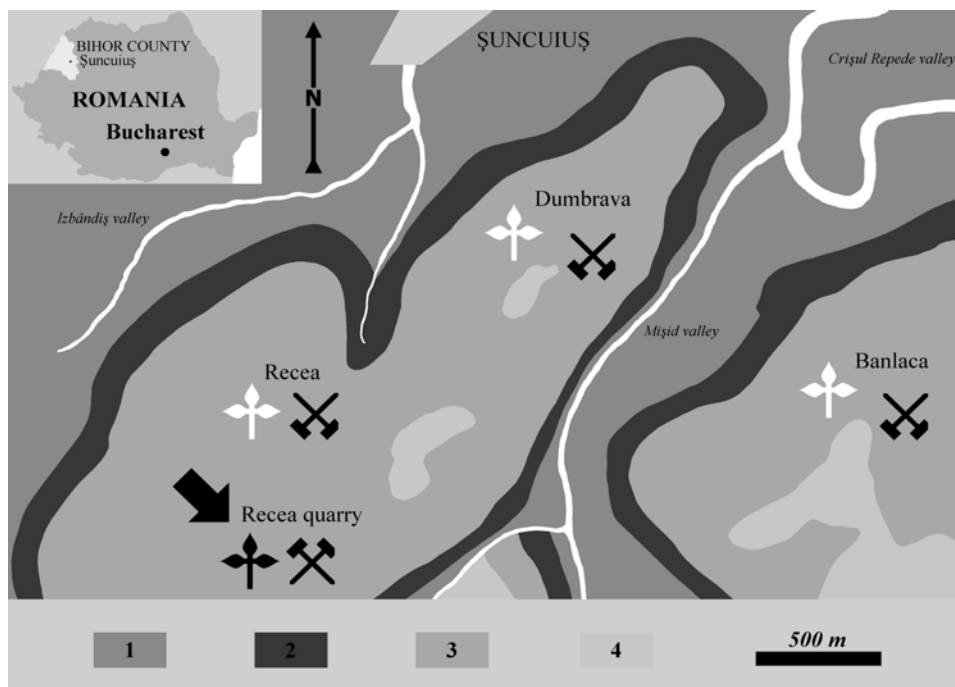


Figure 1. Geological sketch of the Șuncuiuș mining area. White fossil plant leaves indicate old sampling points in closed underground mines; black leaf indicates new sampling points in opencast mine. The flora occurs only in the Recea Member of the Șuncuiuș Formation. The arrow points at the type section of the Recea Member; 1, Ladinian ('Wetterstein'-type limestones); 2, Hettangian *pro parte* (ferruginous siltstones and clays); 3, Hettangian *pro parte* – Lower Sinemurian ('Gresten'-like facies: microconglomerates, quartz sandstones, shales, more or less refractory clays); 4, Upper Sinemurian – Lower Pliensbachian (limestones and silicilites).

main elements of lithostratigraphy in Recea quarry, which is located near the mining operation of Șuncuiș in Bihor county. The flora is found in the Recea Member of the Șuncuiș Formation. The area figured contains one of the most important Lower Jurassic terrestrial sequences in Romania and has been proposed as a scientific conservation site (Czier 1993, 1999a).

Material and history

In the summer of 1988, I was collecting in the Pădurea Craiului Mountains where a block containing a large fossil leaf was found in the grey fireclays of Recea quarry. The sampling point shown in Figure 2, is in the upper fossiliferous horizon of the Recea Member. Since only part of a pinna

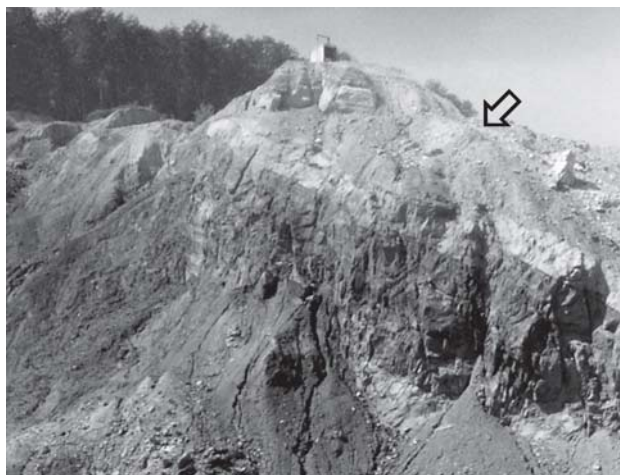


Figure 2. View of part of Recea quarry (Bihor County, Romania). The arrow indicates the sampling point from which the type material of *Receaphyllum grandis* was collected.

was seen at first it was decided to take the block to the Natural Sciences Department of the Bihor County Museum at Oradea. Here, surplus rock was removed followed by splitting it along the plain containing the leaf impression. As a result several fragments were obtained: a large one with the leaf (part),

and five smaller ones (counterpart). Dr Răzvan Givulescu (from Cluj-Napoca) examined the material and determined it as *Pseudoctenis latus* Doludenko when he visited the museum later in 1988.

After several years of thorough investigations and study of the literature, the present author revised the Șuncuiș Flora. During this work it has become obvious that the macroscopic characters of the specimen from Recea quarry are not sufficiently compatible with those of *Pseudoctenis latus* Doludenko as described by Doludenko and Svanidze (1969) for definite assignment to this species. The holotype of *P. latus* from Georgia is a small leaf fragment with pinnae significantly more contracted towards the base than those of the Recea quarry specimen, which is a large leaf showing more macroscopic characters. The holotype has well-preserved cuticles, which are absent from the specimen under discussion. I concluded, therefore, that material without cuticles should only be referred to as *P. cf. latus* (Czier 1997, p. 25). A complete revision of the Recea quarry specimen and the publication of a new name is one of the aims of the present paper. The other aim is to accomplish a critical review and revision of the complete *Pseudoctenis* material from the Carpathian-Pannonian area (Romania and Hungary) and to discuss relevant examples also from other European countries (United Kingdom and Germany).

Description

The specimen consists of the impressions of a very large pinnate leaf. One fragment is more than 40×30 cm (Pl. 1; Pl. 2, fig. 1) and five counterpart fragments are up to 20×15 cm (Pl. 2, fig. 2; Pl. 3, figs 1–4). The preserved part of the leaf has an elongate-triangular habit. The rachis is 21 mm wide at the proximal end, narrowing distally to 13 mm. At first sight, its surface seems to be smooth but closer examination shows that it has fine, irregularly disposed, longitudinal striations. The pinnae are elongate-lanceolate, attached at right angles, alternately to subalternately, never overlapping, with 10–15 mm gaps between them.

Thorough examination demonstrates that the pinnae are attached to the dorsal face of the rachis, the insertion of each involves the entire pinna base. The insertions cover 2–3 mm of the rachis. The pinnae are mostly 130–150 mm long and 25 mm wide with the maximum width in the basal third.

They have entire margins, slightly contracted bases and acuminate apices. Simple veins predominate, rarely dichotomizing once in any part of the pinna. The veins originate from the entire width of the pinna base, slightly diverging in the basal quarter, soon becoming parallel, only slightly converging near the apex, terminating on the margin. There are 31-35 veins in the widest portion of the pinna and the maximum density of the venation is 15 veins cm⁻¹.

Discussion and review

One of the most important characters that Harris (1964, pp. 70–71) stipulates in his emended diagnosis of *Pseudoctenis*, is the lateral attachment of the pinnae. The emended diagnosis is based not only on gross morphological features, but also on cuticular characters of the leaf, one of them being the haplocheilic stomatal apparatus. The lateral attachments of the pinnae, as well as the presence of the cuticles, are therefore indispensable characters for definite assignment of a specimen to *Pseudoctenis*, though Harris (1964, pp. 71–72) still maintained in this genus a few species with dorsal pinna attachments or without cuticles. The above statement has at least three practical implications as noted below.

1. Leaves with no lateral attachment of the pinnae, as well as those without cuticle, are probably better assigned to other genera. However, if assigned by any means to *Pseudoctenis*, an epithet (cf., aff., ?) must precede the generic determination.
2. It is necessary to obtain cuticular evidence for all species of *Pseudoctenis*. If no cuticles are available from the type material, that species should be transferred to a genus for which the diagnosis does not demand cuticular characters.
3. New species of *Pseudoctenis* should only be created on material with preserved cuticles.

The lateral attachment of the pinnae and the cuticular characters should consequently be analysed in all of the species and specimens of *Pseudoctenis*. The complete revision of the genus, with its many species, is not the subject of the present paper, rather my analysis below is restricted to all known material from the fossil flora of Romania and Hungary, and a few relevant examples from the United Kingdom and Germany.

1. The determination *Ctenis asplenioides* (Ettingshausen) Schenk, of the specimen that Staub (1897, p. 332) only described macroscopically from the

Lower Jurassic of Pécs (Mecsek Mountains, Hungary), is doubtful. According to Florin (1933, p. 81) and Harris (1964, p. 102), the diagnosis of the genus *Ctenis* Lindley and Hutton, stipulates not only macroscopical characters, but also cuticular characters. Schenk (1868, p. 219, pl. 25) previously figured a leaf of *C. asplenioides*, but as Staub mentioned, it is unsure whether the figure refers to this specimen or not. The material could be aff. *Ctenis* sp. or, according to the brief description, aff. *Pseudoctenis* sp.

2. The macroscopically figured specimen from the Middle Jurassic of Hârşova (Dobrogea, Romania), published by Dragastan and Bărbulescu (1980, p. 93) under the name *Pseudoctenis latus* Doludenko, has no cuticle, so the specific assignment is doubtful. The specimen consists of two pinna fragments, without preserved rachis; therefore, nothing is known about the insertion. Under the circumstances, the determination is revised here as aff. *Pseudoctenis* sp.

3. The only macroscopically known specimen from the Lower Jurassic of Anina (Banat, Romania), published by Popa (1992, p. 7) under the name *Pseudoctenis oleosa* Harris, is doubtfully assignable to this genus and species. This is because the emended diagnoses of Harris (1964, pp. 70–71, 78) provide cuticular characters for both the genus and species. As the pinnae are attached laterally, the specimen may be assigned to the genus. However, because an epithet must precede both the genus and the species, the determination is cf. *Pseudoctenis* sp.

4. *Pseudoctenis* sp. from the Lower Jurassic of Ponor quarry near Anina, recorded by Popa (1994, p. 14), so long as is not described and not figured, is ?*Pseudoctenis* sp.

5. *Pseudoctenis prossii* described by Van Konijnenburg-Van Cittert *et al.* (1998, p. 17), as a new species from the Jurassic of Germany, is based on specimens without preserved cuticle. It would have been better, therefore, not to have created this species. However, if the material is assigned to this genus, then cf. *Pseudoctenis* sp. is more acceptable.

6. The type material of *Pseudoctenis herriesii* Harris, from the Middle Jurassic of Yorkshire, possesses cuticles, but the pinnae are attached on the face of the rachis. Because they are not laterally attached, if the material is maintained in this genus, the best determination would be aff. *Pseudoctenis* sp. Another possibility is to transfer the species to other genus. Schweitzer *et al.* (2000, p. 42) transferred it to *Nilsonia*.

7. The specimens from the Lower Jurassic of Recea quarry, described by Czier (2000a, p. 59) under the name cf. *Pseudoctenis latus* Doludenko, do

not possess any cuticle. Therefore, the specific determination also is doubtful. The determination is revised here as cf. *Pseudoctenis* sp.

8. The determinations cf. *Pseudoctenis* sp. and aff. *Pseudoctenis* sp. given by Czier (2000a, p. 60) for other specimens described from Recea quarry, are maintained.

9. The Recea quarry specimen described and figured herein, has pinnae attached on the upper face of the rachis. It is not, therefore, a *Pseudoctenis* leaf. Comparing the specimen with the pinnate fossil plant leaves (see also the discussion and comparison in the systematic section), it is not assignable to the genera known so far. Therefore, it is necessary to create a new genus. Considering the general habit of the leaf, this new genus probably belongs to the Cycadopsida, Bennettitales. However, as is seen from the studies of Florin (1933), one of the essential characters of the Bennettitales is the paracytic stomatal apparatus. The specimen has no preserved cuticle, so this character cannot be confirmed, nor ruled out. In consequence, the new genus should be created as a form-genus within the Spermatophytes. The necessity of assignment of the Bennettitalean-like leaves to this group, when cuticles are unknown, was extensively argued in a previous paper (Czier 1996, p. 351).

Systematic palaeontology

SPERMATOPHYTA

RECEAPHYLLUM Czier, gen. nov.

Plate 1; Plate 2, figures 1–2; Plate 3, figures 1–4

Derivation of name. From Recea quarry, Bihor County, Romania.

Type species. *Receaphyllum grandis* Czier, sp. nov.

Diagnosis. Once pinnate leaf. Rachis strong to very strong, covered on small portions by the pinnae basis. Elongate-lanceolate pinnae, with entire margins, attached with whole base to the adaxial face of the rachis. Veins arising from the entire pinna base, parallel or almost parallel, simple or dichotomising once, ending on pinna margins.

Comparisons. Although *Receaphyllum* has some affinities to numerous spermatophyte genera from the Mesophytic, it is clearly distinct from them, as follows.

1. *Zamites* Brongniart 1828 emend. Harris 1969, *Pterophyllum* Brongniart 1828 emend. Harris 1969, *Pseudoctenis* Seward 1911 emend. Harris 1964, and *Moltenia* DuToit 1927, have pinna bases that are symmetrical, in common with the genotype of *Receaphyllum*. However, the *Zamites* pinnae are attached over a small area in the middle of the basal margin, and those of *Pterophyllum*, *Pseudoctenis* and *Moltenia* are attached laterally.
2. *Ctenis* Lindley and Hutton 1834 has laterally inserted pinnae, with anastomosing veins. The same insertion is present in *Keraiaphyllum* Frentzen 1932, the veins being always simple and parallel.
3. Adaxial attachment of pinnae is present in *Ptilophyllum* Morris 1840 emend. Harris 1969, *Dictyozamites* Oldham and Morris 1863 emend. Harris 1969, *Ischnophyton* Delevoryas and Hope 1976 and *Banatozamites* Czier 1996. However, the bases of the pinnae in *Ptilophyllum* cover the whole rachis, and *Dictyozamites* has frequently anastomosed veins. The base of the pinna in *Ischnophyton* is auriculate. *Banatozamites* probably has bipinnate habit, and veins that are slightly curved in an acroscopic direction.
4. *Otozamites* Braun in Münster 1843 emend. Barnard and Miller 1976, and *Sinoctenis* Sze 1931 possess abaxial attached pinnules.
5. *Kurtziana* Frenguelli 1942 emend. Petriella and Arrondo 1982 and *Paracycas* Harris 1964 have once pinnate leaves. However, the characteristic venation of *Kurtziana* is of *Alethopteris*-type. *Paracycas* has a single thickened midrib and no other veins.
6. *Neozamites* Vakhrameev 1962 may have both pinnate and bipinnate leaves. However, whereas its pinnae are toothed at the margins, the margins of pinnae in *Receaphyllum* are entire.
7. *Leptocycas* Delevoryas and Hope 1971 is a slender stem with *Pseudoctenis*-type leaves.
8. *Nilssoniocladus* Kimura and Sekido 1975 has long shoots with long, smooth internodes, short shoots covered with spirally placed rhomboidal leaf scars, and at apex, ‘*Nilsonia*’ leaves.
9. *Coreanophyllum* Kimura and Kim 1982 and *Nipponoptilophyllum* Kimura and Tsujii 1984 do not possess cuticle. In my opinion they also are form-genera of the Spermatophytes. However, these two genera contain only species with bipinnate leaves.

10. *Aricycas* Ash 1991 has a short narrow stalk, with pinnae contracted at their base. The venation is very different from that of *Receaphyllum* because a midrib is present and the lateral veins are anastomosed.

11. The rachis of *Laurozamites* Weber and Zamudio-Varela 1995 is covered with transverse cortical wrinkles, the pinnae bases are constricted with auricles at both corners, and the veins are repeatedly forked.

Receaphyllum grandis Czier, sp. nov.

Plate 1; Plate 2, figures 1–2; Plate 3, figures 1–4

1989 *Pseudoctenis latus* Doludenko; Czier, p. 745, text-fig. 1, pl. 1, fig. 1

1990 *Pseudoctenis latus* Dolud; Givulescu and Czier, p. 13, pl. 1, table 2

1994 *Pseudoctenis latus* Doludenko; Czier, p. 354, table 2

1997 *Pseudoctenis* cf. *latus* Doludenko; Czier, p. 25

Derivation of name. Latin, *grandis*, great, large, big.

Holotype. Hand specimen 16501/1 (Pl. 1; Pl. 2, fig. 1).

Isotype. Hand specimen fragments 16502, 16504, 16505, 16506, 16522/1 (Pl. 2, fig. 2; Pl. 3, figs 1–4).

Repository. Collection of the Natural Sciences Department of Bihor County Museum (Muzeul Țării Crișurilor) at Oradea, Romania.

Type locality. Recea quarry, near the mining town Șuncuiuș, Romania.

Lithostratigraphical and biostratigraphical units. Named and defined by Czier (1999a, b; 2000b, c): the Recea Member of the Șuncuiuș Formation; the *Selenocarpus muensterianus* Subzone of the *Clathropteris meniscioides* Biozone.

Age. Hettangian *pro parte* – Lower Sinemurian.

Diagnosis. Apparently a very large elongate-triangular leaf, with an estimated length of 0.6 m and maximum width of 0.3 m. Very strong rachis, up to 21 mm wide or more. Alternately to subalternately disposed symmetrical pinnae,

typically 140 mm long and 25 mm wide. Pinnae possessing normal to slightly contracted base and acuminate apices. Veins slightly diverging near pinna base, parallel for much of its length, very slightly converging near apex, usually simple, occasionally dichotomizing at different levels.

Palaeophytogeographical note

Among the great many taxa known from Jurassic deposits, a few genera occur only in the European part of the Indo-European region. These few genera are very important because they are elements of the European autochthonous palaeoflora.

A detailed discussion of the palaeophytogeographical classification of the European Jurassic macroflora, with special regard to the Carpathian-Pannonian area, has been published previously (Czier 2000a, 2001). One half from the number of the species from this area are known also from other palaeophytogeographical regions. These are allochthonous species of eastern (Asia) and western (North America) origin, as well as species of European origin, which migrated from here towards East (Siberia) and West (Central to South America). The principal migration routes are represented on a map, in a previous paper (Czier 1998, p. 371, text-fig. 8).

The other half of the species belong to genera described only from Europe, mainly from several localities. However, if a species assigned to one of these genera is known from a single locality, I consider it to be an endemic taxon. Being known from a single locality in Romania, *Receaphyllum grandis* is therefore regarded as an endemic species of the European autochthonous palaeoflora. Obviously, only new records from other localities, could prove its wider distribution, and eventually change this attribution.

Conclusions

1. *Receaphyllum* gen. nov. is considered to be an endemic, autochthonous European taxon.
2. Material attributed to the type species *Receaphyllum grandis*, was formerly erroneously determined as *Pseudecten* *latus* Doludenko.
3. No specimens in fossil flora of Romania and Hungary are clearly assignable to the genus *Pseudecten*.

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Explanations of plates

Plate 1

Receaphyllum grandis Czier gen. et sp. nov.; Recea quarry, Bihor county, Romania; Șuncuiș Formation, Recea Member; *Clathropteris meniscioides* Biozone, *Selenocarpus muensterianus* Subzone; Lower Jurassic (Hettangian *pro parte* – Lower Sinemurian); General view of the leaf (16501/1) – holotype. Scale bar represents 20 mm.

Plate 2

Receaphyllum grandis Czier gen. et sp. nov.; Recea quarry, Bihor county, Romania; Șuncuiș Formation, Recea Member; *Clathropteris meniscioides* Biozone, *Selenocarpus muensterianus* Subzone; Lower Jurassic (Hettangian *pro parte* – Lower Sinemurian); Details showing the attachment of pinnae; Scale bar represents 10 mm.

Fig. 1. Leaf part from the distal third (16501/1) – holotype.

Fig. 2. Leaf counterpart from the proximal third (16522/1) – isotype.

Plate 3

Receaphyllum grandis Czier gen. et sp. nov.; Recea quarry, Bihor county, Romania; Șuncuiș Formation, Recea Member; *Clathropteris meniscioides* Biozone, *Selenocarpus muensterianus* Subzone; Lower Jurassic (Hettangian *pro parte* – Lower Sinemurian); Counterpart leaf fragments – isotype; Scale bar represents 10 mm.

Fig. 1. From the proximal third of the specimen (16502).

Fig. 2. From near the proximal end of the specimen (16504).

Fig. 3. From the proximal end of the specimen (16505).

Fig. 4. From the middle third of the specimen (16506).



Plate 1

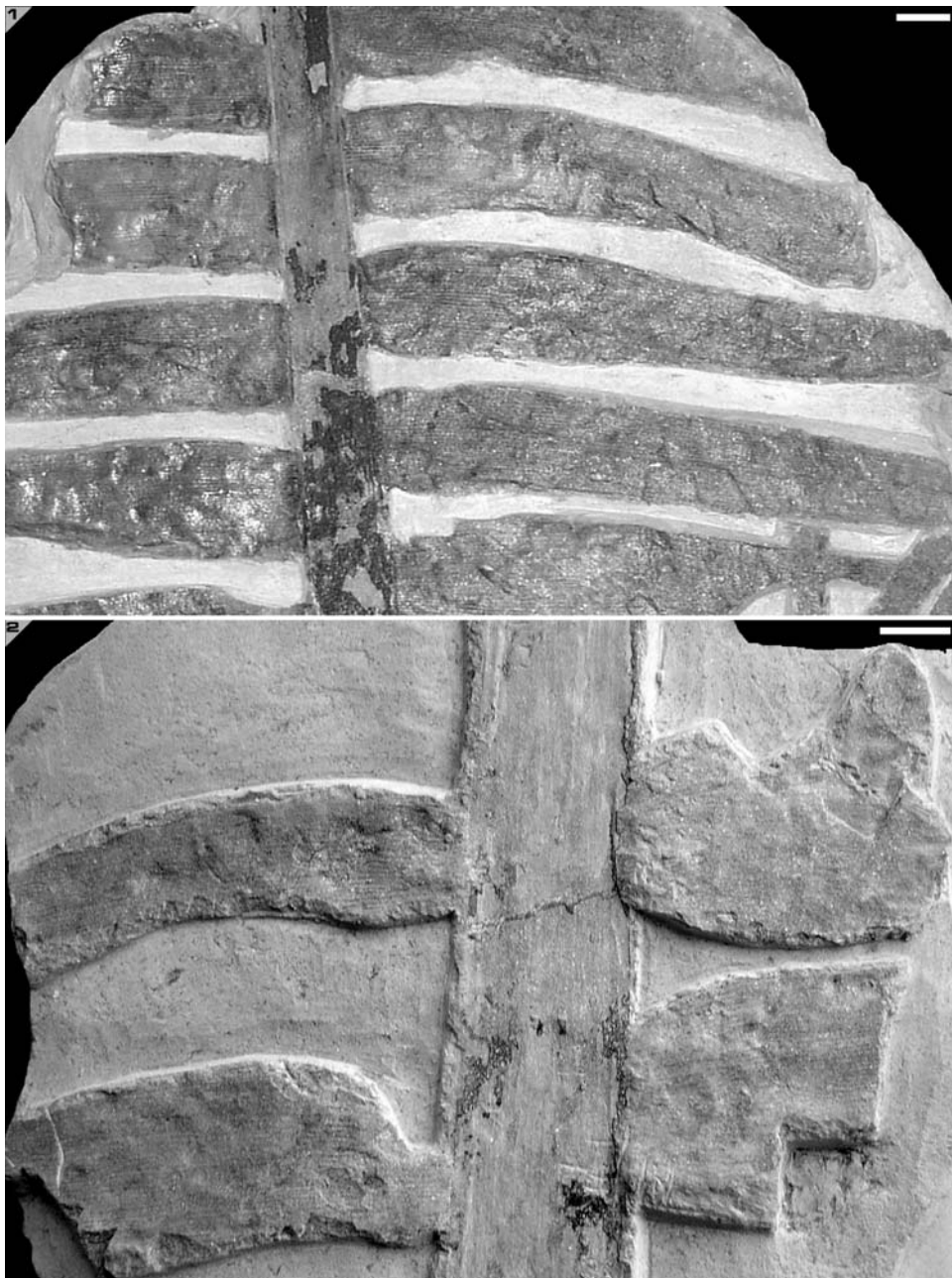
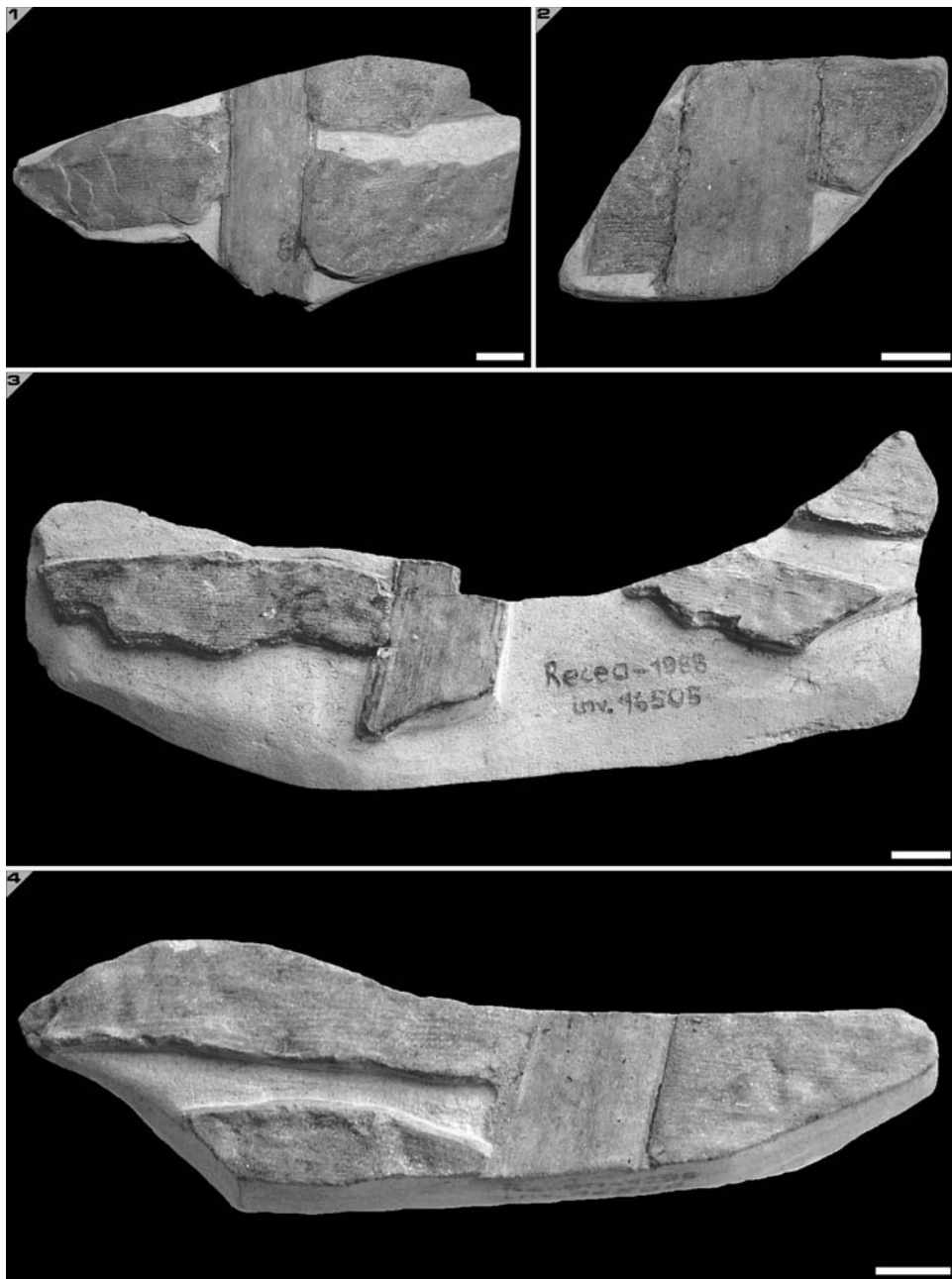


Plate 2

*Plate 3*