

Gondomaria grandeuryi (Zeiller) Wagner & Castro

a, citation and similar papers at core.ac.uk

brought to you

provided by Revistes Catalanes

Surroca (prov. Girona, Catalonia, Spain)

Robert H. WAGNER*

RESUMEN

WAGNER H. R. *Gondomaria grandeuryi* (Zeiller) Wagner & Castro, 1998 en el contexto de una flora del Estefaniense superior de Surroca (Girona, Catalunya, España).

De una discusión breve sobre la composición de la flora de Surroca, de edad Estefaniense C probable, se pasa a la descripción de uno de sus elementos raros, *Gondomaria grandeuryi* (Zeiller), de afinidad desconocida. Se comenta el género *Gondomaria* Teixeira 1964 y se compara con *Rhachiphyllum* Kerp 1986, un género de forma “calliptérico” de edad autuniense.

Palabras clave: Estefaniense, Catalunya, Calliptérico, Helechoide, *Gondomaria*.

ABSTRACT

A brief discussion on the general composition of the Stephanian C flora of Surroca is followed by a description of *Gondomaria grandeuryi* (Zeiller), a rare form of fernlike foliage of uncertain affinity. The genus *Gondomaria* Teixeira 1964 is discussed and comparison is made with *Rhachiphyllum* Kerp 1986, a “callipterid” formgenus of Stephanian C (early Autunian) to later Autunian ages.

Keywords: Stephanian, Catalonia, Callipterid, Fernlike, *Gondomaria*.

* Centro Paleobotánico, Jardín Botánico de Córdoba, Avda. de Linneo, s/n, 14004 Córdoba, España.

INTRODUCTION

In the context of a revision of the fossil flora from the Surroca-Camprodón Coalfield in the province of Girona, Catalonia, undertaken on behalf of the Museu de Ciències Naturals in Barcelona, in collaboration with Julio Gómez-Alba, Curator of Palaeontology, a single specimen with fernlike pinna fragments is identified here as the unusual species *Gondomaria grandeuryi* (Zeiller) Wagner & Castro. The genus *Gondomaria* was introduced by Teixeira (1964) with a single species based on specimens from the upper Stephanian of the Douro Basin in Portugal. Wagner & Lemos de Sousa (1982) later described an additional species of *Gondomaria* from upper Westphalian strata in northern Portugal, but this attribution was subsequently withdrawn (Wagner & Castro, 1998), thus leaving *Gondomaria grandeuryi* as the sole representative of this genus. Although it shows a superficial resemblance to the “callipterid” group of plants, this species of fernlike foliage is of unknown affinity since no reproductive organs have been found.

FLORAL CONTEXT

The Surroca-Ogassa-Camprodón Coalfield, also known in the literature as San Juan de las Abadesas (Sant Joan de les Abadesses), is a classical site in Spain for upper Stephanian plant remains. Jongmans (1951), in his general review of the Carboniferous floras of Spain, mentioned San Juan de las Abadesas (province Gerona) with a number of fossil lists from the literature which he attributed to Stephanian B, although he mentioned also that R. Zeiller (in Faura i Sans, 1928) had suggested the upper Stephanian (read: Stephanian C). Jongmans (1951) added the identification of a representative collection of plant fossils sent to him by Faura at the Geological Bureau in Heerlen (presently in the collection of the National Museum of Natural History in Leiden, the Netherlands), and which he attributed to the middle Stephanian (read: Stephanian B *sensu* St. Étienne). Jongmans visited this coalfield in 1955, but did not manage to study the plant remains collected on that occasion before he died in 1957. These specimens are also in Leiden. Jongmans (1951) overlooked a list of plant fossils identified by P. Bertrand (Lille) and published by Dalloni (1930).

Subsequently, a single species from Surroca, *Alethopteris pennsylvanica* var. *pyrenaica* Willière ex Wagner, was described from the Faura i Sans Collection in Heerlen by Wagner (1968). Not much later, Álvarez-Ramis, Pi-Radondy & Doubinger (1969) provided a more up-to-date list of plant fossils from Surroca, from which they deduced a Stephanian B age (read: Stephanian B *sensu* St. Étienne). They also provided a list of spore genera, noting the rarity of *Lycospora* and a relative abundance of *Densosporites* which, at that time, was regarded as surprising for a deposit of late Stephanian age. Since the densospores are linked mainly to the long-ranging isoetalean lycopsid *Omphalophloios*, the implications are more of an environmental/palaeogeographical nature than stratigraphic. The first more or less complete illustrations of plant fossils from Surroca are due to Álvarez Ramis, Doubinger & Diéguez Jiménez (1971),

this time under the alternative name of Ogassa. They allotted a Stephanian C age to this flora. Since these authors mentioned that the fossil remains recorded were obtained from coal tips visited in 1970, it is not clear whether the remains identified in the earlier paper (1969) were also taken into account. However, this seems unlikely since the specimens figured are quite fragmentary and thus probably derived from a weathered coal tip. The fragmentary nature of these remains and the fact that most specimens were figured at natural size, has made it difficult to check on the identifications. Nonetheless, the following species are regarded as more or less recognisable from the illustrations (generic names converted to present-day nomenclature): *Gondomaria grandeuryi* (Zeiller) Wagner & Castro? (illustrated as *Callipteridium* cf. *gigas* [Gutbier] Weiss), *Alethopteris pennsylvanica* var. *pyrenaica* Willièrè, *Barthelopteris germari* (Giebel) Zoderow & Cleal (too poorly illustrated to see the characteristic net veining), *Oligocarpia leptophylla* (Bunbury) Grauvogel-Stamm & Doubinger (apparently figured under the names of *Sphenopteris burgkensis* Sterzel and *Sphenopteris cristata* Brongniart, although the illustrations are too poor to be judged beyond doubt), *Nemejcopteris feminaeformis* (Schlotheim) Barthel, *Polymorphopteris polymorpha* (Brongniart) Wagner, *Pecopteris robustissima* Wagner. The other species recorded by Álvarez Ramis *et al.* (1971) cannot possibly be judged from the illustrations, and should probably be ignored as doubtful records (as mentioned before the majority of specimens are very fragmentary apart from being poorly illustrated).

A single specimen of *Annularia stellata* (Schlotheim) Wood was figured as forma *longifolia* nov. forma from Camprodón (same coalfield as Surroca) by Diéguez (1985). This refers to *Annularia longifolia* Brongniart, which is generally regarded as a synonym of *Annularia stellata*. The recognition as a special form is questionable and so is the nomenclatorial procedure.

From a locality at Coll de la Caritat, NE of Ogassa, and presumably belonging to the same basin, Broutin & Gisbert (1985) recorded a large number of species which collectively suggested a latest Stephanian age to them (read: Stephanian C). They illustrated the following elements (generic names converted to present-day usage):

- Neurocallipteris neuropteroides* (Göppert) Cleal *et al.* (lám. III, fig. 7)
- Barthelopteris germari* (Giebel) Zoderow & Cleal (lám. III, fig. 11)
- Odontopteris minor* Brongniart (lám. III, fig. 12) (not mentioned in plate explanation)
- Callipteridium pteridium* (Schlotheim) Zeiller (lám. III, fig. 1 – not identifiable from the illustration which is suggestive of *Polymorphopteris polymorpha* [Brongniart] Wagner)
- Callipteridium* cf. *zeilleri* Wagner (lám. III, fig. 3) (probably better referred to *Callipteridium rochei* Zeiller)
- Alethopteris zeilleri* Ragot (lám. III, fig. 8)
- Taeniopteris multinervia* Weiss – *abnormis* Göppert (lám. III, figs 5, 5a = possibly *Neurocallipteris gallica* [Zeiller] Cleal & Shute)
- Taeniopteris jejuna* Grand'Eury (lám. III, fig. 6)
- Polymorphopteris pseudobucklandi* (Andrä) Wagner (lám. III, fig. 2 – figured at natural size which is too small for proper recognition)
- Pecopteris clintonii* Lesquereux (lám. III, fig. 4 = to be regarded as *Pecopteris* sp.)
- Pecopteris hemitelioides* Brongniart (lám. III, fig. 10 = *Pecopteris robustissima* Wagner)
- Calamites cistii* Brongniart (lám. III, fig. 9)

Doubinger, Robert & Broutin (1978) and later Broutin & Gisbert (1985) published an Autunian flora from Coll de Jou, between the villages of Bruguera and Ogassa, West of the Surroca Coalfield (generic names adjusted to current nomenclature):

- Walchia piniformis* Sternberg (1978, pl. II, figs 1-3; 1985, lám. II, fig. 1)
Ernestiodendron filiciforme Florin (1978, pl. I, fig. 2; pl. II, fig. 6)
Otovicia hypnoides (Brongniart) Kerp et al. (1985, lám. II, fig. 1)
Hermitia germanica (Florin) Kerp & Clement-Westerhof (1978, pl. I, fig. 1; pl. II, figs 4-5; 1985, lám. II, fig. 2)
Ullmannia frumentaria (Schlotheim) Göppert (1978, pl. I, figs 3-5; pl. II, figs 7-9; 1985, lám. II, fig. 3)
Barthelopteris germari (Giebel) Zoderow & Cleal (1985, lám. II, fig. 4)
Oligocarpia leptophylla (Bunbury) Grauvogel-Stamm & Doubinger (1985, lám. II, fig. 6)
Lobopteris waltonii (Corsini) Wagner (1985, lám. II, figs 7, 7a = probably *Oligocarpia leptophylla* (Bunbury) Grauvogel-Stamm & Doubinger)
Pecopteris cf. *monyi* Zeiller (1985, lám. II, fig. 5 = *Pecopteris* sp.)
Annularia sp. (1985, lám. II, fig. 8 = *Annularia carinata* Gutbier)

These floral remains, which were reasonably well illustrated on both occasions, were attributed to “classical Autunian” but regarded as being of the same age as the upper Stephanian flora of Surroca-Ogassa, although belonging to a different environment. This may be so, but the possibility remains that higher strata are represented since the authors correlated on lithological characters rather than lateral continuity, or so it seems from the description in the 1985 paper, which does not include a geological map.

In a well illustrated Atlas of Fossils, Gómez-Alba (1988) figured several floral remains from Surroca-Ogassa, as follows (generic names adjusted to current nomenclature):

- Barthelopteris germari* (Giebel) Zoderow & Cleal (lám. 8, fig. 3)
Alethopteris pennsylvanica var. *pyrenaica* Willièrè (lám. 6, fig. 5)
Cyclopteris sp. (lám. 7, fig. 5)
Taeniopteris multinervia Weiss (lám. 10, fig. 5)
Poacordaites sp. (lám. 12, fig. 6 = *Poacordaites microstachys* [Goldenberg] Zeiller)
Nemejcopteris feminaeformis (Schlotheim) Barthel (lám. 4, fig. 1)
Pecopteris arborescens (Schlotheim) Brongniart (lám. 4, fig. 2)
Pecopteris cyathea (Schlotheim) Brongniart (lám. 4, fig. 3)
Pecopteris daubreei Zeiller (lám. 4, fig. 4 = *Polymorphopteris subelegans* [Potonié] Wagner)
Polymorphopteris polymorpha (Brongniart) Wagner (lám. 4, fig. 8)
Sphenophyllum oblongifolium (Germar & Kaulfuss) Unger (lám. 2, fig. 10)
Calamostachys tuberculata Sternberg (lám. 3, fig. 2 – incompletely figured)
Macrostachya carinata (Germar) Zeiller (lám. 3, fig. 3)

These specimens have been seen by the present writer.

Arnau & Vicente (1991) figured some drawings of *Alethopteris pennsylvanica* var. *pyrenaica* Willièrè from the Surroca-Ogassa Coalfield, referring to this form as

Alethopteris pyrenaica. They compared with *Alethopteris grandinii* (Brongniart) Göppert since this was the name applied to this *Alethopteris* in the older literature. Finally, Arnau (1993) published photographs and brief descriptions of ovules (“seeds”) collected in the Surroca-Ogassa Coalfield.

The revision undertaken by the present writer on the basis of specimens kept in the Museu de Ciències Naturals in Barcelona suggests the presence of taxa as listed below:

- Gondomaria grandeuryi* (Zeiller) Wagner & Castro (figured in the present paper)
Odontopteris brardii Brongniart
Cyclopteris sp.
Alethopteris pennsylvanica var. *pyrenaica* Willière
Barthelopteris germari (Giebel) Zodrow & Cleal
Linopteris gangamopteroides (de Stefani) Wagner
Linopteris neuropteroides (Gutbier) Potonié
Callipteridium gigas (Gutbier) Weiss
Callipteridium zeilleri Wagner
Taeniopteris multinervia Weiss
Dicksonites decorspii (Zeiller) comb. nov. (basonym *Sphenopteris decorspii*)
Dicksonites plueckenetii (Schlotheim) Sterzel
Oligocarpia leptophylla (Bunbury) Grauvogel-Stamm & Doubinger
Sphenopteris cf. *mathetii* Zeiller
Nemejcopteris feminaeformis (Schlotheim) Barthel
Diplazites longifolius (Brongniart) Göppert
Pecopteris arborescens (Schlotheim) Brongniart
Pecopteris cyathea (Schlotheim) Brongniart
Pecopteris cf. *densifolia sensu* Zeiller non Göppert
Pecopteris jongmansii Wagner
Pecopteris cf. *laxenervosa* Wagner & Lemos de Sousa
Pecopteris robustissima Wagner
Pecopteris spp.
Lobatopteris corsinii Wagner
Polymorphopteris integra (Andrä) Wagner
Polymorphopteris polymorpha (Brongniart) Wagner
Polymorphopteris cf. *subelegans* (Potonié) Wagner
Senftenbergia elaverica (Zeiller) Wagner
Senftenbergia gruneri (Zeiller) Wagner
Calamites cruciatus Sternberg
Calamites suckowii Brongniart
Annularia mucronata Schenk
Annularia sphenophylloides (Zenker) Gutbier
Annularia stellata (Schlotheim) Wood
Asterophyllites equisetiformis (Schlotheim) Brongniart
Macrostachya carinata (Germar) Zeiller
Sphenophyllum oblongifolium (Germar & Kaulfuss) Unger
Sphenophyllum cf. *verticillatum* (Schlotheim) Zeiller
Sigillaria brardii Brongniart

Sigillaria polygonalis Vetter
Sigillaria cf. *ovata* Sauveur
Lepidostrobos sp.
Cordaites sp.
Poacordaites microstachys (Goldenberg) Zeiller
Stigmaria ficoides Sternberg
“seeds”

The preliminary results of this revision, which has not yet been concluded, do confirm that a late Stephanian flora is present, either Stephanian B *sensu* St. Étienne, or, more likely, Stephanian C. It is the intention to figure and describe these specimens in due time. In the present paper the rare species *Gondomaria grandeuryi* (Zeiller) Wagner & Castro is described on the basis of records in the literature and the single plant remain as figured.

Genus *Gondomaria* Teixeira, 1964

Diagnosis

Medium-sized fronds, at least bipinnate, with intercalated pinnules in the upper part of primary pinnae. Ultimate pinnae gradually tapering. Pinnules strongly asymmetrical, with basiscopic side fused with the rachis entirely or partially, with a constriction on the acroscopic side. In the basal part of major pinnae the pinnule bases are constricted on both sides. Midrib excentrically placed, and dissolving into numerous lateral veins in the apical part of pinnules. Lateral veins ascending, oblique, forking more than once, at least partly derived from rachis on the basiscopic side of pinnules.

Remarks

When Teixeira (1964) introduced this genus on the basis of several plant impressions from the upper Stephanian of São Pedro da Cova, north Portugal, he did not provide a proper diagnosis, only the description of the species *Gondomaria alethifolia* Teixeira, which covered the genus. This species is a synonym of *Alethopteris grandeuryi* Zeiller, from the upper Stephanian of Commentry, Massif Central, France (Wagner & Castro, 1998). Teixeira compared with *Odontopteris*, *Alethopteris*, *Mariopteris* and *Callipteridium*, on the generic level, but he did not make the connection with Zeiller's species from Commentry. He also failed to compare with callipterids, such as *Autunia* (formerly *Callipteris*) *conferta* (Sternberg) Kerp. The similarity between *G. alethifolia* and *A. grandeuryi* was first observed by Wagner & Lemos de Sousa (1982), who drew attention to the fact that Franke (1913) regarded *Alethopteris grandeuryi* Zeiller as synonymous with *Callipteris discreta* Weiss, a species which was later incorporated with *Neuropteris obtusa* (Brongniart) Wagner & Castro by Wagner & Castro (1998), who refigured Weiss's type specimen

(counterpart). Doubinger (1956, p. 94) had already rejected the synonymy proposed by Franke. Wagner & Lemos de Sousa (1982) applied the name *Gondomaria* also to a species from upper Westphalian strata in the Serra de Bougado, north Portugal, but this attribution was subsequently withdrawn by Wagner & Castro (1998). It is suggested here that this still unidentified upper Westphalian species may be an unrelated pectopterid close to *Lobatopteris aspidioides* (Sternberg) Wagner.

Wagner & Lemos de Sousa (1982) mentioned that Weiss's "*Callipteris*" *discreta* (which they admitted as a synonym of *Gondomaria grandeuryi* – see above) resembled callipterids of the *Callipteris conferta* group, and suggested the possibility that this species, of Westphalian D age, might be a precursor. However, since the available information was regarded as insufficient, they left the possible relationship as an open question. A possible link with the callipterids of the "*Callipteris*" *conferta* group may indeed be explored with regard to *Gondomaria grandeuryi* (Zeiller) Wagner & Castro. There is a certain resemblance, not so much with *Autunia conferta* (Sternberg) Kerp, but with non-lobate forms of *Rhachiphyllum schenkii* (Heyer) Kerp, which were often identified as *Callipteris conferta* (see the extensive list of synonymy in Kerp, 1988, p. 319). When introducing the genus *Rhachiphyllum*, Kerp did not compare with *Gondomaria* Teixeira, a genus which has generally been ignored in the literature.

Rhachiphyllum Kerp (in Kerp & Haubold, 1988, p. 145) was diagnosed as follows: "Regular bipinnate to tripinnate, sometimes dichotomising, small to medium-sized fronds. Pinnae in alternating to subopposite position. Primary rachis usually robust, longitudinally striated, basal part naked, widened at the base. Intercalary pinnules attached to the primary rachis. Intercalary pinnules usually resembling the other pinnules. Pinnules entire-margined to pinnately lobed. Venation alethopteroid". Kerp typified *Rhachiphyllum* on "*Sphenopteris*" *lyratifolia* Göppert 1842. The genus *Rhachiphyllum* was regarded as being of unknown affinity.

Although some of the specimens figured as *Rhachiphyllum schenkii* by Kerp (1986, 1988) are difficult to separate from *Gondomaria grandeuryi*, the rather limited number of remains illustrated by Zeiller (1898) and Teixeira (1964) do not allow the full range of variation to be established for Zeiller's species, whereas the abundant material illustrated by Kerp from a single locality, Sobernheim in western Germany, has made this possible for *Rhachiphyllum schenkii*. However, it would seem that only a limited amount of overlap exists (see later on). It is noted that the genus *Rhachiphyllum* has been defined in the first place on *Rhachiphyllum lyratifolius* (Göppert) Kerp, which is a rather different form characterised by short ultimate pinnae with very little variation in size. In fact, these pinnae have also been described in the literature as lobate pinnules. These lobes or small pinnules are largely fused at the base and are provided with a simple venation. This species is sufficiently different from *Gondomaria grandeuryi* to warrant separate treatment, even on the generic level. Kerp (1986; in Kerp & Haubold, 1988) assigned the following species to the genus *Rhachiphyllum*: *R. lyratifolius* (type species), *R. curretiense* (Zeiller) Kerp, *R. diabolicus* (Zeiller) Kerp, *R. lodevense* (Brongniart) Kerp, *R. schenkii* (Heyer) Kerp, *R. subauriculatus* (Weiss) Kerp. The strongly lobate pinnules with a gradual transition into small pinnae which characterise the type of *Rhachiphyllum curretiense* (Zeiller, 1892, pl. VIII, fig. 3 – lectotype), do not invite comparison with *Gondomaria grandeuryi* (Zeiller). Similarly, *Rhachiphyllum diabolicus* as figured by Zeiller (1892, pl. VIII, fig. 5 – holotype) shows lobate pinnules of the same general characteristics

as *R. curretiense*, but which are much smaller in size. *Rhachiphyllum lodevense* (Brongniart, 1836, pl. 115, fig. 5 – holotype) seems quite a different form, which is not immediately recognisable as a callipterid, were it not for the later figuration by Zeiller (1898) and Doubinger (1956, pl. VIII, figs 2-3). Again, the lobate pinnules grading into small pinnae provide the comparable character with the other species mentioned. *Rhachiphyllum schenkii* (Heyer) is based on a single specimen (holotype) refigured by Kerp (1986, p.100, fig. 11), which may be difficult to separate from *Rhachiphyllum subauriculatus* (Weiss, 1869, Taf. IV-V, fig. 3 – holotype). The rather small, lobate pinnules with constrictions on both the acroscopic and basiscopic sides allow a clear distinction from *Gondomaria grandeuryi* (Zeiller).

It would thus appear that *Gondomaria* Teixeira and *Rhachiphyllum* Kerp should be kept separate. In both cases, one is dealing with callipterid forms of unknown affinity in the absence of reproductive structures.

Gondomaria grandeuryi (Zeiller) Wagner & Castro, 1998
Pl. 1, figs A, B

- 1888/90 *Alethopteris Grand'Euryi* Zeiller, in Renault & Zeiller, p. 207-211, pl. XXII, figs 1-4.
 ? 1904 *Odontopteris alpina* (Sternberg) Geinitz – Potonié (pars), fig. 1, non figs 1-5.
 ? 1930 *Odontopteris Jeanpaulii* Bertrand, p. 52, fig. 8.
 1956 *Alethopteris grand'euryi* Zeiller – Doubinger, p. 94-95.
 1964 *Gondomaria alethifolia* Teixeira, p. 821-822, pls I-VII.
 ? 1971 *Callipteridium* cf. *gigas* (Gutbier) Weiss – Álvarez Ramis et al., p. 271, lám. I, fig. 13.
 1975 *Gondomaria alethifolia* Teixeira – Boureau & Doubinger, in Boureau, p. 372, 373, fig. 309 (after Teixeira, 1964, pl. I – reduced).
 1998 *Gondomaria grand'euryi* (Zeiller) – Wagner & Castro, p. 11.

Material

A single specimen with the impression of three separate fragments of pinnae of the last order. Catalogue number 19474 of Vidal Collection (two negatives and one positive).

Description of the specimen in hand

Thin rachises on which relatively large, closely spaced pinnules (14-19 mm length) are inserted obliquely, with the entire base attached. Pinnule sides straight to slightly convex, tapering in the upper half into a rounded apex. Basiscopic side sloping but not apparently confluent with adjacent pinnule; acroscopic side slightly

constricted. Venation markedly asymmetrical, with midrib perpendicular to rachis and positioned near the acroscopic side of pinnule, and several subsidiary veins on the basisopic side. Lateral veins strongly marked, oblique and generally twice forked. They are widely spaced (at least 12 veins per cm).

Remarks

The types of *Gondomaria grandeuryi* Zeiller, as figured and described from the Commeny Coalfield in the Massif Central, France, consist of four specimens which are all fragments of pinnae of the penultimate order with oblique pinnules showing variable insertions from strongly decurrent to almost neuropteroid. The acroscopic side seems always constricted, even in the most strongly decurrent pinnules, but the basisopic side is also constricted where the more neuropteroid pinnules in the lower part of major pinnae are involved. No evidence of intercalary pinnules has been reported by Zeiller, and this explains the original attribution to *Alethopteris* rather than *Callipteris*. Exactly the same form, with the identical variation in pinnule insertion, but showing intercalary pinnules in the upper part of pinnae of the penultimate order, was described later by Teixeira (1964) under the name of *Gondomaria alethifolia*, also from upper Stephanian strata, in this case from the Douro Coalfield in northern Portugal. In terms of frond reduction, as described by Laveine et al. (1977) for *Callipteridium*, it would seem that the specimens recorded by Zeiller and Teixeira, presumably belonging to one and the same species, *Gondomaria grandeuryi* (Zeiller) Wagner & Castro, represent an early callipterid form in which frond reduction had not advanced to the extent that intercalary pinnules would be present throughout the penultimate pinnae, but only in the highest parts thereof.

The specimen figured here from the upper Stephanian of Surroca (Fig. 1) is too fragmentary to show penultimate rachises. It also fails to show pinna terminals, and is moreover too fragmentary to allow judging the full range of variation in pinnule insertion which is so clear in both Zeiller's and Teixeira's specimens. On the other hand, the pinnule size and shape accord well with the morphological characters shown by the French and Portuguese specimens. The alternative identifications *Autunia conferta* (Sternberg) Kerp and *Rhachiphyllum schenkii* (Heyer) Kerp are rejected because of the differences in pinnule size and shape, those of *Autunia conferta* being relatively shorter and thus more subtriangular, whilst *R. schenkii* displays generally smaller pinnules which show a tendency to become lobate. In both cases intercalary pinnules are present throughout. Only very fragmentary specimens might give rise to confusion between *Gondomaria grandeuryi* and forms with non-lobate pinnules of *Rhachiphyllum schenkii*.

The strongly asymmetrical venation, with the perpendicularly inserted midrib being situated near the acroscopic side of pinnules, is a notable character which the specimen from Surroca shares with Zeiller's types. Poor preservation makes the vein count unreliable in the specimen recorded here. The record of approximately 12 veins per cm probably does not take into account the ultimate vein endings which do not seem to have been preserved. Zeiller's vein diagrams do, in fact, display a higher vein density (about 18 per cm).

It is possible, though uncertain, because of the fragmentary nature and diagrammatic rendering of the specimen, that the holotype and only recorded specimen of *Odontopteris jeanpaulii* Bertrand (= *Odontopteris alpina pars*, as figured by Potonié, 1904), belongs to *Gondomaria grandeuryi*.

As noted in the list of synonymy, it is possible that Álvarez Ramis *et al.* (1971) figured a fragment of *Gondomaria grandeuryi* (as *Callipteridium cf. gigas*), but this assumption is difficult to confirm without a reexamination of the actual specimen (the illustration is too poor to be judged adequately).

Occurrence

Upper Stephanian of Commentry (France), São Pedro da Cova (Portugal), and Surroca (Spain); possibly also upper Westphalian of Saarland (Germany)? (*Odontopteris jeanpaulii*).

CONCLUSION

The single specimen recorded here from the Surroca Coalfield, Catalonia, shows that the rare species *Gondomaria grandeuryi* (Zeiller) occurs more widely than the two previous records from central France and north Portugal indicated. In the absence of fertile material the affinity of this species of fernlike foliage is unknown, but its apparent resemblance to callipterids and the presence of intercalary pinnules in the higher part of a penultimate pinna as figured by Teixeira (1964) tend to suggest that this is an early form of callipterid foliage, of late Stephanian age.

ACKNOWLEDGEMENTS

To Museu de Ciències Naturals of Barcelona for the agreement to study the upper Stephanian flora of Surroca, and to Julio Gómez-Alba for his collaboration. Hans Kerp is thanked for comments on *Rhachiphyllum* in comparison with *Gondomaria*, and the provision of literature.

REFERENCES

- Álvarez Ramis, C., Doubinger, J. & Diéguez Jiménez, M.C. 1971. Estudio paleobotánico de la flora de Ogassa (Gerona). *Estudios Geológicos*, **27** (3), 267-277.
- Álvarez-Ramis, C., Pi-Radondy, M. & Doubinger, J. 1969. Sur la flore fossile du Carbonifère de Surroca (Gerona, Espagne). *Comptes rendus Académie des Sciences, Paris*, **268**, 2559-2561.
- Arnau, J. 1993. Assaig de classificació d'òvuls de Pteridospermals. *Butlletí Centre d'Estudis de la Natura del Barcelonès Nord*, **9** (3), 234-246.
- Arnau, J. & Vicente, J. 1991. Apreciacions en torn al gènere *Alethopteris* predominant als jaciments carbonífers de Surroca-Ogassa (Ripollès). *Butlletí Centre d'Estudis de la Natura del Barcelonès Nord*, **7** (1), 33-38.
- Bertrand, P. 1930. *Bassin houiller de la Sarre et de la Lorraine. I. Flore fossile. 4: Neuroptéridées*. Études des Gîtes Minéraux de la France, Paris, 58 p.
- Boureau, E. 1975. *Traité de Paléobotanique. IV (2). Pteridophylla (première partie)*, 768 p. Masson et Cie, Éditeurs. Paris.
- Brongniart, A. 1828-1838. *Histoire des végétaux fossiles, ou recherches botaniques et géologiques sur les végétaux renfermés dans les diverses couches du globe*. Paris, Amsterdam, G. Dufour et Ed. d'Ocagne, Libraires-Éditeurs, tome I, 488 p., 166 pls (1828-1837: Livraisons 1-12; Livraison 10: 1836), tome II, 72 p. (1838).
- Broutin, J. & Gisbert, J. 1985. Entorno paleoclimático y ambiental de la flora stephano-autuniense del Pirineo catalán. *Compte Rendu 10e Congrès Carbonifère, Madrid 1983*, **3**, 53-66.
- Dalloni, M. 1930. Étude géologique des Pyrénées catalanes. *Annales Faculté des Sciences de Marseille*, **26** (3), 373 p.
- Diéguez, M.C. 1985. Cinco nuevas formas de *Annularia stellata* (Schlotheim) Wood: distribución e interés paleoecológico. *Estudios Geológicos*, **41**, 503-510.
- Doubinger, J. 1956. Contribution à l'étude des flores autuno-stéphaniennes. *Mémoires Société géologique de France*, **75**, 180 p.
- Doubinger, J., Robert, J.-F. & Broutin, J. 1978. Données complémentaires sur la flore permo-carbonifère de Surroca-Ogassa (province de Gérone - Espagne). *103e Congrès national des sociétés savantes, Nancy 1978, sciences*, **2**, 39-45.

- Faura i Sans, M. 1928. Résumé de nos connaissances sur l'Anthracolitique de la Catalogne et ses relations chronologiques avec les formations similaires de la Péninsule Ibérique. *Compte Rendu Congrès Carbonifère*, Heerlen 1927: 821-852.
- Franke, F. 1913. *Alethopteris discreta*. In: H. Potonié, *Abbildungen und Beschreibungen fossiler Pflanzen-Reste*, **IX-173**, 5 p. Königliches Preussisches Geologische Landesanstalt. Berlin.
- Gómez-Alba, J. 1988. *Guía de Campo de los Fósiles de España y de Europa*. Ediciones Omega. Barcelona, 925 p.
- Göppert, H.R. 1841-46. *Die Gattungen der fossilen Pflanzen verglichen mit denen der Jetztwelt und durch Abbildungen erläutert*. Verlag A. Henry, Bonn, 120 p.
- Jongmans, W.J. 1951. Las floras carboníferas de España. *Estudios Geológicos*, **7 (14)**, 281-330.
- Kerp, J.H.F. 1986. On *Callipteris* Brongniart from the European Rotliegend basins. Proefschrift Rijksuniversiteit Utrecht.
- Kerp, J.H.F. & Haubold, H. 1988. Aspects of Permian palaeobotany and palynology. VIII. On the reclassification of the West- and Central-European species of the form-genus *Callipteris* Brongniart 1849. *Review Palaeobotany and Palynology*, **54**, 135-150 (also in Kerp, 1986, with different paging).
- Kerp, J.H.F. 1988. Aspects of Permian palaeobotany and palynology. X. The West- and Central-European species of the genus *Autunia* Krasser emend. Kerp (Peltaspermaeae) and the form-genus *Rhachiphyllum* Kerp (callipterid foliage). *Review Palaeobotany and Palynology*, **54**, 249-360 (also in Kerp, 1986, with different paging).
- Laveine, J.-P., Coquel, R. & Loboziak, S. 1977. Phylogénie générale des Calliptéridiacées (Pteridospermopsida). *Géobios*, **10 (6)**, 757-847.
- Potonié, H. 1904. *Odontopteris alpina* (Sternberg) Geinitz. In: H. Potonié, *Abbildungen und Beschreibungen fossiler Pflanzen-Reste*, **II-22**, 6 p. Königliches Preussisches Geologische Landesanstalt. Berlin.
- Renault, B. & Zeiller, R. 1888-89. Études sur le terrain houiller de Commentry. Flore fossile. *Société Industrie minérale*, 746 p. (Texte 1888), pls I-LXXV (Atlas 1888/89).
- Teixeira, C. 1964. Une nouvelle plante fossile du Stéphanien des environs de Porto (Portugal). *Compte Rendu 5^e Congrès Carbonifère*, Paris 1963, **2**, 821-822.

-
- Wagner, R.H. 1968. Upper Westphalian and Stephanian species of *Alethopteris* from Europe, Asia Minor and North America. *Mededelingen Rijks Geologische Dienst, (C)*, **3-1 – n° 6**, 319 p.
- Wagner, R.H. & Castro, M.P. 1998. *Neuropteris obtusa*, a rare but widespread late Carboniferous pteridosperm. *Palaeontology*, **41 (1)**, 1-22.
- Wagner, R.H. & Lemos de Sousa, M.J. 1982. A middle Westphalian flora from the Alvarelhos strip near the Serra de Bougado, Santo Tirso, North Portugal. *Comunicações Serviços Geológicos de Portugal*, **68 (2)**, 257-266.
- Weiss, C.E. 1869-72. *Fossile Flora der jüngsten Steinkohlenformation und des Rothliegenden im Saar-Rhein-Gebiete*. Verlag A. Henry, Bonn, 250 p.
- Zeiller, R. 1892. *Bassin houiller et permien de Brive. II. Flore fossile*. Études des Gîtes Minéraux de la France, Paris, 132 p.
- Zeiller, R. 1898. Contribution à l'étude de la flore ptéridologique des schistes permien de Lodève. *Bulletin Muséum d'Histoire naturelle de Marseille*, **1**, 6-69.

Plate 1

Gondomaria grandeuryi (Zeiller) Wagner & Castro, 1998

A. Impression of two partial pinnae of the last order, x 1.

B. x 3.

Lámina 1

Gondomaria grandeuryi (Zeiller) Wagner & Castro, 1998

A. Huella (impresión) de dos pinnas incompletas del último orden, x1

B. x 3.

