ACTA PALAEOBOTANICA

XVIII (1): 13—18, 1977

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ON *BILSDALEA DURA* HARRIS *(CONIFERAE)* FROM THE JURASSIC OF POLAND

Bilsdalea dura Harris *(Coniferae)* z jury Polski

ABSTRACT. A small flora was found in clays of the Middle Jurassic from Orlej near Grojec consisting mainly of fragments of linear leaves. One of them is *Bilsdalea dura* Harris belonging to a genus known only from the Jurassic of Yorkshire and Bornholm. A description of the leaves and their cuticle is given and a comparison with the two known species. The leaf is regarded as identical with the Yorkshire species.

GEOLOGY AND MATERIAL

In 1965 Dr. S. Czarniecki showed the author an outcrop of Jurassic clays at the entrance of the Orlej porphyry quarry near Zalas. This quarry lies a few km to the SE of Grojec, the Jurassic locality of Raciborski. The geology of the Orlej quarry was described by Dżułyński (1955) and Czarniecki & Łydka (1958). According to Dr. Czarniecki (personal communication) in the cutting leading to the quarry there are successive outcrops of limestones of the Upper Jurassic, brown sandstones of the Middle Jurassic and packets of grey and variegated clays in tectonic contact with black shales containing a fauna of the uppermost Viséan. The contact of the Jurassic strata with each other is also tectonic and is related to the fault tectonics of this area.

In places the clays show plant fragments and pyrite concretions. When sieved, they yield well preserved leaf fragments about 1 cm long, seeds, megaspores and small fragments of wood. Most of this flora consists of linear leaves with a tough cuticle which belong to two plants, a yet undescribed species of *Pseudoto-*

rellia and *Bilsdalea dura* which is described in the present paper. The associated plant fragments suggest an age similar to that of the Grojec flora, i. e. Middle Jurassic — Upper Liassic to Bajocian — (Harris 1977).

SYSTEMATIC DESCRIPTION

Coniferae incertae sedis

Genus *Bilsdalea* Harris 1952

Bilsdalea dura Harris

Pl. I, figs. 1—6

1952 *Bilsdalea dura* Harris: 371, Text-figs. 6 A-F, 7 A-Z, 8 A-E, 9 A, D, F.

Description. Ultimate shoots slender, covered completely with decurrent leaf bases, leaf scars horizontal in spiral arrangement. Leaves linear, needle like, coriaceous, 6 to at least 23 mm long (maximum length of leaf unknown), 1—2·5 mm wide, often curved in lower part, vein occasionally distinguishable on upper surface. Leaf basis gradually narrowing but not forming a distinct petiole, often twisted, decurrent. Leaf apex abruptly narrowing, truncate and thickened or ending in an acute tip up to 0·5 mm long; leaf margin entire, leaf substance occasionally showing numerous thin dark fibres. Upper side without stomata, on lower side two narrow, not sunken stomatal bands through the whole length of leaf.

Upper cuticle consisting of longitudinal rows of well marked elongated rectangular cells, their length 1—5 times their width. Anticlinal walls more or less straight, pitted; periclinal walls flat, their surface delicately mottled. Epidermal cells of lower cuticle outside the stomatal bands similar to those of upper cuticle, but their length 2—8 times their width and their periclinal walls often showing a cutinised raised band along the middle.

Stomatal band consisting typically of 7—8 (5—8) files of longitudinally orientated stomata, adjacent or divided for some distance into two, occasionally more narrower bands by 1—3 files of ordinary epidermal cells. In files stomata separated by one epidermal cell or adjacent stomata sharing a polar cell. Stomata with four subsidiary cells differentiated into two smaller polar cells and two larger lateral cells, occasionally two lateral cells on one side. Encircling cells absent or not forming a complete ring. Subsidiary cells bulging, their surface showing a delicate radiating or longitudinal striation. Inner walls of the lateral subsidiary cells extended over entrance of stomatal pit and giving it an hour-glass like outline. Guard cells sunken below surface, their narrow thinly cutinised ends visible below the polar subsidiary cells. Their broad median parts with

a thickly cutinised periclinal wall approximately of the height of the lateral subsidiary cells and reaching to about the middle of their width. Stomatal slit straight and narrow on upper side, widening inwards and surrounded by thinly cutinised walls.

Occasionally in axil of leaf a basal part of a shoot surrounded by minute scales and showing a scar at its end.

Discussion and comparison. The leaves of the genus *Bilsdalea* show a number of characters which make them easy to recognize. They have a gradually narrowing twisted basis without a petiole, they are decurrent and their apex is either truncate or it shows an acute tip. Nevertheless the genus was so far known only from the Jurassic of Yorkshire and Bornholm. In Yorkshire the species *B. dura* was found in 45 localities (Harris 1952). From Bornholm the species *Bilsdalea angustifolia* was described by Florin (1958). According to Florin *B. angustifolia* differs from *B. dura* mainly in its narrower leaf and stomatal band and in the smaller number of stomatal files in a stomatal band. The leaf apex of *B. angustifolia* is acute to acuminate while it is obtuse to acute in *B. dura*. When these characters are considered, the leaf from Orlej falls into the range of variation shown by *B. dura* and differs from that of *B. angustifolia*. The leaves from Orlej are 1—2·5 wide, while they are only 0·8—1·5 wide in *B. angustifolia*. The number of stomatal files in a band which is 5—8 in the leaf from Orlej, is also larger than in *B. angustifolia*, where it is 3—7. In *B. dura* from Yorkshire the width of the leaf is 0·6—2·6 mm and a stomatal band shows 5—10 files of stomata. The leaf apex in the leaf from Orlej is truncate to acuminate and therefore more like in *B. dura*.

There are small differences from *B. dura*. The arrangement of stomata in the plant from Orlej appears more crowded and the stomata appear shorter and wider, though leaves with narrower subsidiary cells are also found. The surface of the subsidiary cells shows a delicate, often radiating striation, while figures of *B. dura* (Harris 1952, p. 375, fig. 8B) show a mottled surface. I think, however, that these differences are not significant enough to separate the Orlej leaf from *B. dura*.

I do not understand fully the structure of the stomata. When seen from above in the light microscope they appear to consist of four subsidiary cells surrounding the opening of the stomatal pit. The guard cells are apparently seen at a lower focus below the lateral subsidiary cells and they appear to be of a similar length, but usually half as wide. However, when seen from below the picture is not so clear.

It is interesting to note that in another locality near Kraków a few cuticle fragments and a leaf tip of *Bilsdalea* were found which show more elongated subsidiary cells and more frequent encircling cells than the leaves from Orlej and thus resemble more closely the leaves from Yorkshire. However, all the epidermal cells show striations. This material is too scant to allow specific determination.

Affinities. Professor Harris (1952) compared single characters of the leaf of *Bilsdalea dura* with those of various living conifers. He reached the conclusion that no living or fossil conifer shows the same combination of characters as *Bilsdalea* and therefore the leaf is unclassifiable. He thinks that the affinities may be established only when the reproductive organs are found. Florin (1958) was also of the opinion that the systematic position of *Bilsdalea* among the conifers remains an open question.

Acknowledgements

I would like to thank Dr. S. Czarniecki for showing me the outcrop in Orlej and for information about its geology. My thanks are due to Professor T. M. Harris who inspected the material of *Bilsdalea* from Orlej and confirmed its determination.

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STRESZCZENIE

BILSDALEA DURA HARRIS *(CONIFERAE)* Z JURY POLSKI

W glinkach środkowej jury odsłoniętych po lewej stronie wejścia do kamieniołomu Orlej koło Zalasu (por. Dżułyński 1957; Czarniecki & Łydka 1958), położonego na SE od Grojca, jurajskiego stanowiska flory opisanej

przez Raciborskiego, znaleziono drobne fragmenty roślin o dobrze zachowanej budowie. W materiale przeważają dwa typy równowąskich liści pokrytych skórką o dość grubej warstwie kutykuli. Jeden z nich to nie opisany na razie gatunek rodzaju *Pseudotorellia* (*Ginkgoales*), a drugi to *Bilsdalea dura*, gatunek znany dotychczas tylko z jury Yorkshire.

Podano opis liści i budowy ich skórki, który porównano z dwoma znanymi dotychczas gatunkami *Bilsdalea* i stwierdzono, że szczątki z Orleja należą do gatunku stwierdzonego w Yorkshire. *Bilsdalea* posiada cechy występujące u różnych grup *Coniferae*, a tym samym bliższe ustalenie jej pozycji systematycznej stanie się możliwe dopiero, gdy zostaną znalezione owocowania tej rośliny.

Plate I

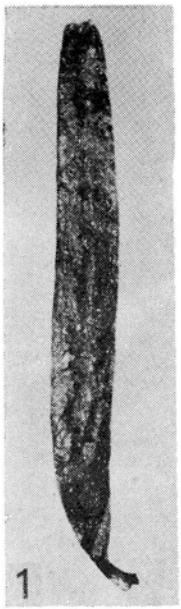
Bilsdalea dura Harris

1. Leaf; S 862, × 5
2. Upper cuticle of leaf; S 863, × 300
3. Shoot base covered with scales in axil of small leaf; S 864, × 10
4. Lower cuticle of leaf showing stomatal band in the middle and normal epidermal cells to the left and right, upper focus showing entrance of stomatal pit; S 863, × 300
5. Lateral subsidiary cell showing striation; S 863, × 1000
6. The same as in fig. 4, lower focus showing stomatal slit; S 863, × 300

Tablica I

Bilsdalea dura Harris

1. Liść; S 862, × 5
2. Górna kutykula liścia; S 863, × 300
3. Nasada pędu pokryta łuskami wyrastająca z kąta małego liścia; S 864, × 10
4. Dolna kutykula liścia ukazująca pas szparkowy w środku i zwykłe komórki skórki po prawej i lewej stronie, górny poziom ostrości, widoczne otwory przedsionków aparatów szparkowych; S 863, × 300
5. Boczna komórka pomocnicza aparatu szparkowego ukazująca prążkowanie; S 863, × 1000
6. To samo miejsce, co na fig. 4, dolny poziom ostrości, ukazujący szparki aparatów szparkowych; S 863, × 300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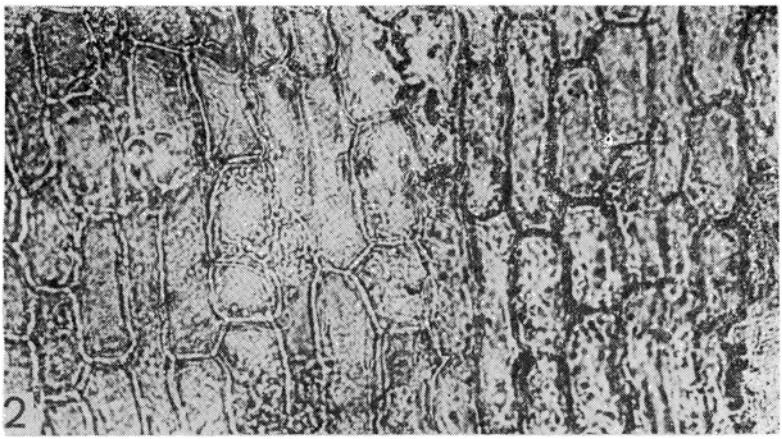
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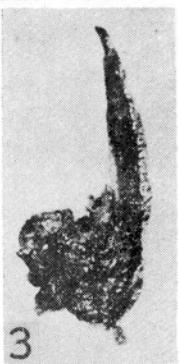
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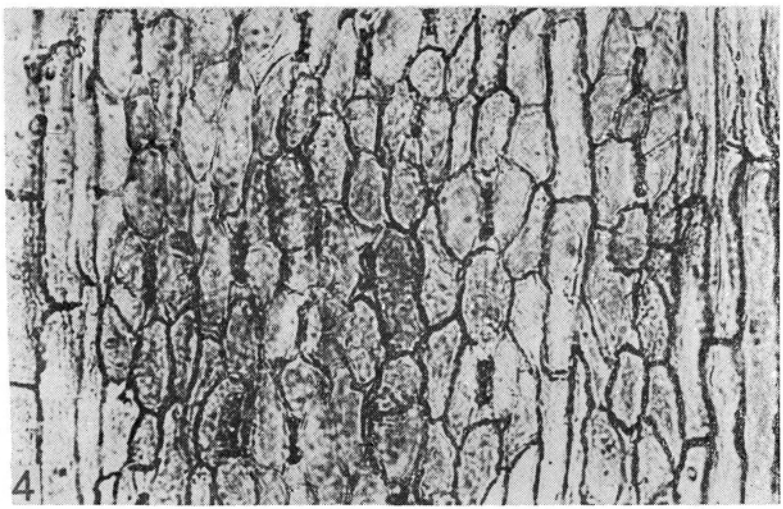
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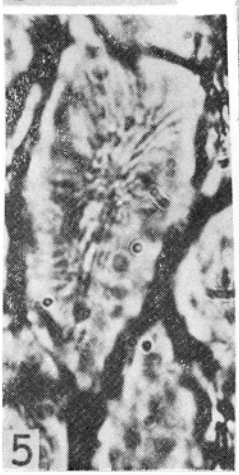
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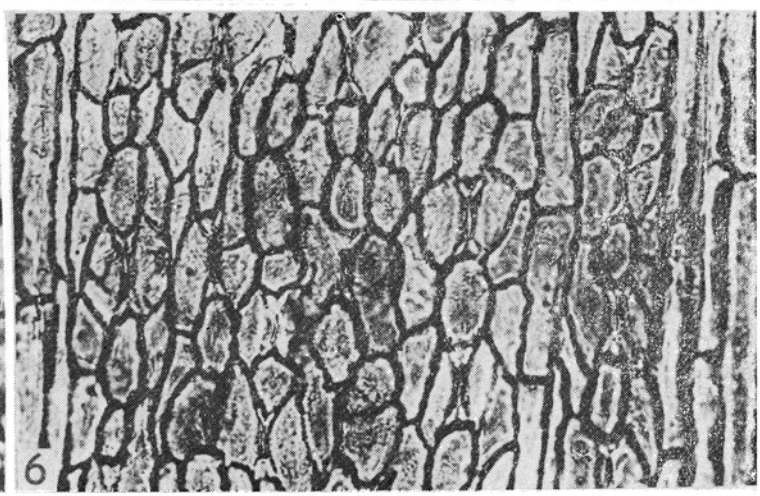
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