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B. D. SHARMA and D. R. BOHRA

PETRIFIED ARAUCARIAN MEGASTROBILI FROM THE JURASSIC OF THE RAJMAHAL HILLS, INDIA

Skamieniałe szyszki araukarii z jury Rajmahal Hills, India

ABSTRACT. A description is given of petrified araucarian seed bearing cones collected from Pakur in the Rajmahal Hills. Cones large, rounded; seed scales woody, ligule and bract scale small. Seeds long inverted with dicotyledonous embryo. Sometimes, two ovules on a scale. Comparison is made with the allied araucarian cones and isolated seed scales known from the Mesozoic rocks.

INTRODUCTION

Araucariaceae is one of the oldest families of true conifers known since the Triassic (Seward & Ford 1906) and had a world wide distribution in the past; now only two genera are known which are restricted to the southern hemisphere (Sporne 1965). Representatives of this family occur frequently in the Mesozoic rocks of India in the form of woods, vegetative twigs, ovuliferous scales and megastrobili (Feistmantel 1876, 1877; Sahni 1928, 1931; Sahni & Rao 1933; Mittre 1954, 1956; Bose & Maheshwari 1973). As Mittre (1954) has given the history in detail, it is unnecessary to present it here. However, *Araucarites bindrabunensis* Mittre (1954) is the only petrified megastrobilus described so far from India. The present material is still better preserved and shows almost all the internal details. It was collected from the fossiliferous locality of Pakur in the Santhal Pargana district of Bihar. Megastrobili are found embedded in a hard chert which is yellowish white and rests on a thick layer of trap. Slides were prepared by the usual grinding and polishing processes and mounted in canada balsam.

DESCRIPTION

There are a number of specimens of araucarian megastrobili in the authors collection. Some of them are complete (Pl. I, fig. 1) while others possess either partly preserved cones (Pl. I, fig. 2) or only the detached seed scales (Pl. I, fig. 3). The strobilus is large, 6·2—8·5 cm in diameter. It consists of a central axis, 1·5—1·8 cm in diameter and many spirally arranged and closely placed seed scales (Pl. I, fig. 2). Each scale measures 2·1—2·6 × 0·8—0·9 cm and shows an expanded distal end (Pl. I, fig. 3). There is a single, adaxial inverted ovule on each scale. Sometimes, two ovules are produced on a scale (Pl. I, fig. 5) as in the living species *Araucaria bidwilli* (Mitra 1927; Wilde & Eames 1955). Mildenhall & Johnston (1971) also reported the occurrence of two ovules per scale in an *Araucarites* sp. described from the Lower Cretaceous of New-Zealand. The seed scale is wedge shaped with a well developed, parenchymatous distal portion (Pl. I, fig. 4). The ovuliferous scale closely adheres to the bract scale, so much so, that no visible distinction is present between the two types of scales. Unlike in many other species of *Araucarites*, the bract scale is not elongated in the present material. Epidermal cells of the scales are peculiar in being provided with heavy thickenings on their radial walls (Pl. I, fig. 4) and give a dentate appearance, similar to that described in *Araucarites bindrabunensis* Mittre (1954). The central axis possesses well developed pith without resin canals. Surrounding the pith there are a number of endarch primary xylem strands and a well developed secondary xylem zone.

The seeds are elongated, 1·5—1·8 × 0·7—0·8 cm in size and inverted i. e. micropyle facing towards the central axis (Pl. I, fig. 6). The seed possesses a thick, nonvascularised integument which is differentiated into three layers i. e. sarcotesta, sclerotesta and endotesta (Pl. I, fig. 5). The sclerotesta forms the thickest zone i. e. 1·2—1·5 mm wide and is made up of narrow, closely placed and horizontally orientated, thick walled cells. It is thickest at the chalazal end, and gradually becomes thinner towards the micropylar part. The endotesta is a narrow, 1—2 cells thick zone (Pl. I, fig. 5). Its cells are very distinct from those of the middle layer. Similarly, the sarcotesta is also narrow and forms a 2—3 layer cells thick (Pl. I, fig. 5). It is not preserved in many of the seeds. Between the sarcotesta and the scale tissue there is a zone of thin walled cells, arranged radially like the periderm cells (Pl. I, fig. 5). The nucellus remains free from the integument in the major part except the chalazal end. In some of the seeds, the nucellus in the micropylar zone has shrunk and gives a wavy or zigzag appearance, similar to that reported in *Araucaria mirabilis* by Stockey (1975). According to Darrow (1936) this is probably due to crushing or digestion by the pollen tube. In some of the seeds the nucellus has protruded out beyond the micropyle. The megagametophyte is large, but not found well preserved in the present material. The embryo is dicotyledonous.

COMPARISON

The present material compares well with *Araucarites bindrabunensis* Mittre (1954) in size, mode of preservation, nature of seeds and structure of epidermal cells of the scales. Like the latter, the cone is large, found embedded in a silicified chert, seeds are elongated, cylindrical and inverted. The ovuliferous scale is woody. It differs from *A. bindrabunensis* in the absence of a long bract scale and other anatomical details. In the present material sometimes, two ovules are seen on a scale while in *A. bindrabunensis* this condition is not known.

From the Mesozoic rocks of India a large number of isolated and detached seed scales are known (Feistmantel 1876, 1877; Sahni 1928; Mittre 1956; Bose & Maheshwari 1973). Comparison was made with them, but the present material differs from all in the elongated shape of the scales and structure of seeds.

In the mode of preservation and structure of the cone, the present material can also be compared with *Araucaria mirabilis* (Spag.) Calder (Stockey 1975) and *Araucarites* sp. Mildenhall & Johnston (1971). However, in the latter types the ligule is very prominent and the bract scale is a quite long, spine like structure.

The present material seems to be quite different from the known species of *Araucarites*, but further work is needed to determine its taxonomic status.

In the fossiliferous locality of Pakur in addition to the araucarian megastrobili petrified coniferous leaves and araucarian stems are also found. Perhaps in the future their relationship with the cones described above may be established.

Department of Botany, University of Jodhpur, Jodhpur 342001, India.

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STRESZCZENIE

SKAMIENIAŁE SZYSZKI ARAUKARII Z JURY RAJMAHAL HILLS, INDIA

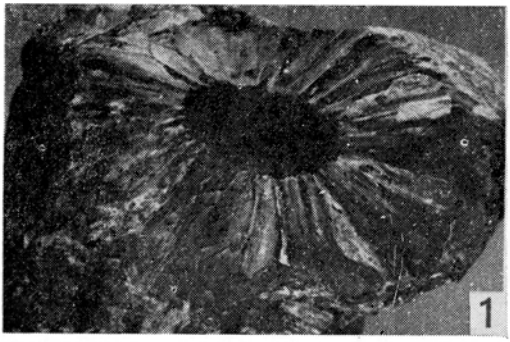
Podano opis skamieniałych szyszek araukarii z nasionami zebranych w Pakur, Rajmahal Hills i porównano je z szyszkami i łuskami nasiennymi araukarii ze skał mezozoicznych. Szyszki z Pakur różnią się od wszystkich dotąd opisanych gatunków *Araucarites*, lecz określenie ich pozycji taksonomicznej wymaga dalszych badań.

PLATE

Plate I

1. *Araucarian megastrobilus.* T. S. Central axis and surrounding scales; × 1
2. Same. Partly preserved cone with spirally arranged scales; × 1
3. Same. Two isolated seed scales with ovules; × 3
4. Same. Distal portion of seed scales and dentate epidermal cells; × 24
5. Same. Two ovules on a scale in cross section. Integument thick, differentiated into layers. Nucellus free; × 24
6. Same. L. S. Micropylar portion of seed with shrunken nucellus; × 24

Abbreviations used: OS — ovuliferous scale, S — seed, IN — integument, E — epidermis, N — nucellus, M — micropyle, SA — sarcotesta, SC — sclerotesta, EN — endotesta.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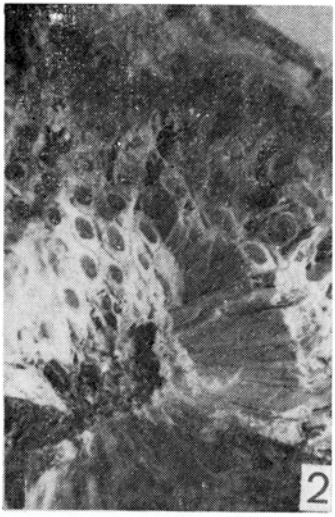
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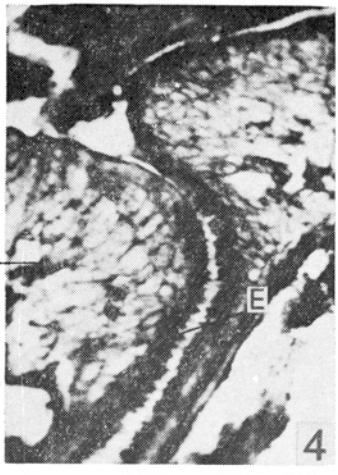
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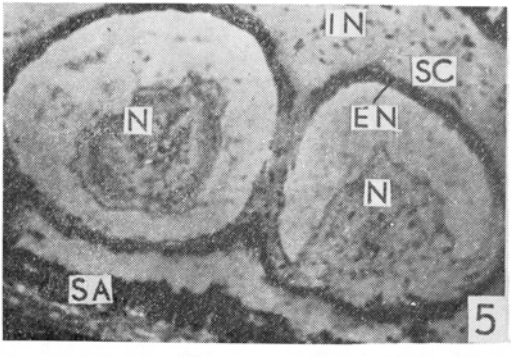
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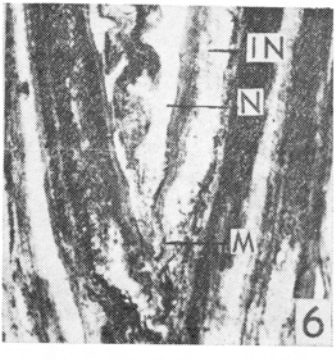
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