STUDIES IN THE DECCAN INTERTRAPPEAN FLORA — 1. ON A PETRIFIED OVULIFEROUS CONE FROM MOHGAON CHERTS IN THE DECCAN

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ABSTRACT

A female conifer cone is described here from the well-known locality of Mohgaon Kalan (22°1'N.; 79°11'E.) in the Deccan Intertrappean Series of Madhya Pradesh. The petrified cone shows resemblance in some characters with the ovuliferous cones of the family Abietineae. The flora of this locality is regarded as early Tertiary, and most probably Eocene.

INTRODUCTION

A FEMALE conifer cone is described here from the Intertrappean beds of Mohgaon Kalan. So far only a few cones have been described from the Deccan Intertrappean Series. Sahni (1931) described in detail three species of ovuliferous cones, viz. *Takliostrobus alatus*, *Indostrobus bifidolepis* and ?*Pityostrobus crassitesta*. *Takliostrobus alatus* and ?*Pityostrobus crassitesta* were found at Takli near Nagpur, while the exact locality of *Indostrobus bifidolepis* is unknown. The above three cones belong to Hunter and Hislop collection of the British Museum. All the three cones show abietinean features with certain peculiarities of their own.

Apart from the Deccan Intertrappean Series, not a single species of conifer cone has been reported so far from any other Tertiary formation in India.

DESCRIPTION

A part of the ovuliferous cone was embedded in a small block of chert lying in a field near the village of Mohgaon Kalan. The cone was exposed on one side of the chert block in a tangential plane (slightly oblique) and on further examination it was found that only a part of the cone on one side of the cone-axis is present. The specimen being very small, only 8 mm. thick, its structure was followed through by gradual grinding and serial sketching at regular intervals. Some peel sections were also prepared, but they did not yield good results. Consequently photographs of the cone at different levels were taken in reflected light. The last stage of grinding was made into a thin longitudinal section, which revealed all the important anatomical details. A part of the cone was also cut in transverse plane and a section prepared for study.

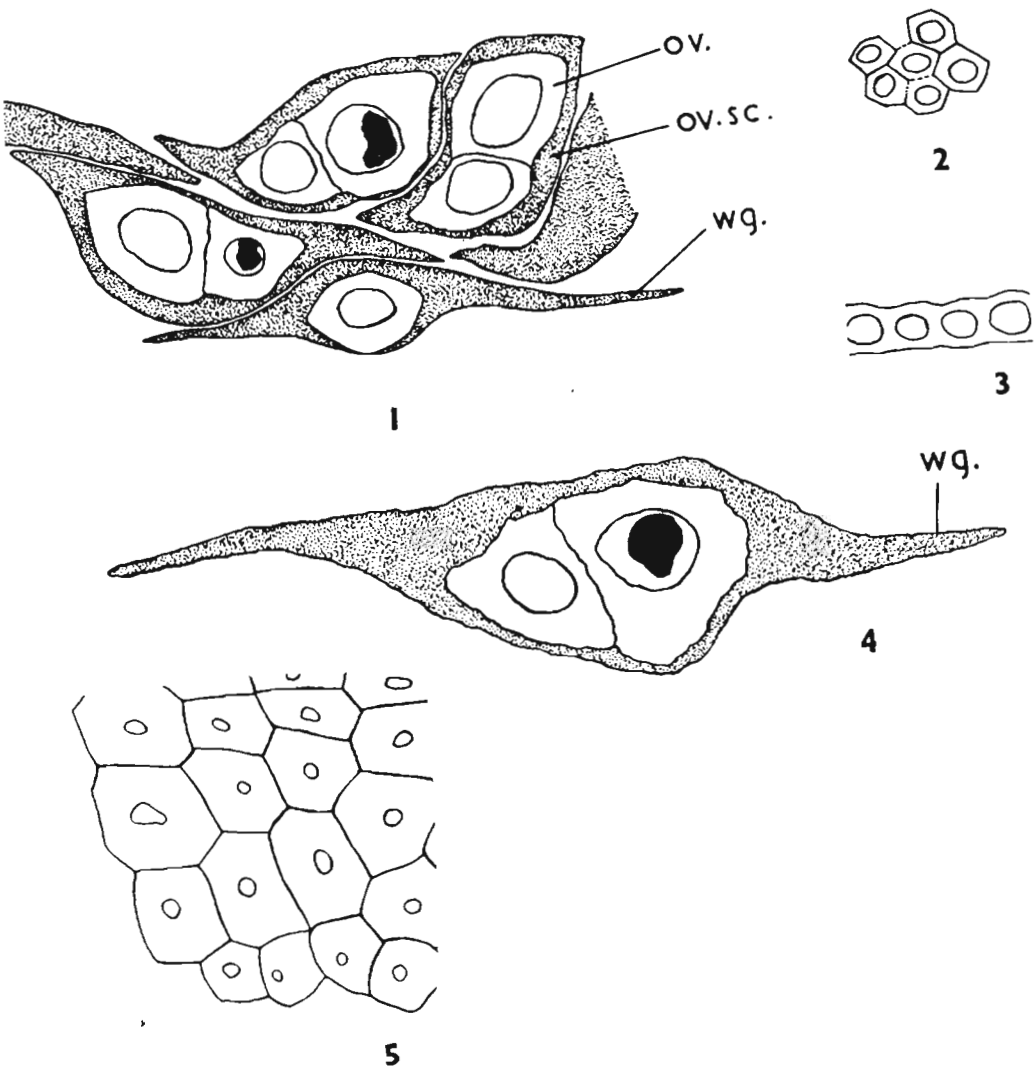
As the cone is incomplete, the information obtained so far remains to be supplemented by further observations. The diameter of the cone is 2-2·1 cm. and its length as seen in the present specimen is only 2·5 cm. (PL. 1, FIG. 3). The axis of the cone is not present in the specimen. From the serial longitudinal sections, it is evident that the ovuliferous scales are closely arranged in spiral order round an axis.

Cone-scales — The scales, as seen in the incomplete specimen, are about 7 mm. long and 4-5 mm. broad (PL. 1, FIGS. 1, 3, 4). They are very thick in their middle region and are expanded horizontally with their margins thinning out into wings which overlap those of the neighbouring scales (PL. 1, FIG. 3; TEXT-FIG. 1). From a number of serial drawings of the cone it appears that the scales run horizontally for some distance and then take a curve upwards. Probably it also forms a thin lamina near its apex. The double nature of the cone-scales could not be seen in the present incomplete specimen, which represents only a part cut tangentially a little away from the cone-axis. It is just possible that a small bract-scale may have been present near the axis. The scales have usually two ovules (PL. 1, FIGS. 1, 3) embedded in it but those at the apex are sterile (PL. 1, FIG. 3). A few scales in the middle region of the cone also appear to be sterile (PL. 1, FIG. 3). The scales on the whole do not show satisfactory preservation. In some parts of the scales, where the structures are somewhat clear, they show thick-walled, polygonal cells (TEXT-FIG. 2). The wings of the scales sometimes possess a few small cavities which appear to be of secretory nature (PL. 1, FIG. 2).

In a few scales which are badly preserved, there are a number of big, irregular spaces which may be due to poor preservation in the scales. The epidermis of the scale is made up of thick-walled (TEXT-FIG. 3), often somewhat globular cells with their lumen usually filled with brown (resinous ?) substance (PL. 1, FIG. 2). The vascular supply of the cone-scales could not be seen due to poor preservation.

Ovules—There are two ovules embedded (PL. 1, FIGS. 1, 3) in each ovuliferous scale. The ovules as seen in the specimen are about 4·5 mm. in length and 1 mm. in diameter. They appear to be more or less horizontal and placed at a distance of about 2-2·5 mm. from the apex of each scale. The two ovules of each scale lie close together. In some cases one ovule seems to be larger than the other (PL. 1, FIG. 3; TEXT-FIG. 4).

Usually two ovules are present in each scale, but in one of the scales only one ovule is seen (PL. 1, FIG. 1; TEXT-FIG. 1). The



TEXT-FIGS. 1-5 — 1. Cross-section of few ovuliferous scales (*ov. sc.*) with embedded ovules (*ov.*). *wg.*, wing. × 9·8. 2. Thick-walled cells of the ovuliferous scales. × 405. 3. Thick-walled epidermal cells. × 270. 4. Cross-section of an ovuliferous scale with two ovules. Margins of the scale form thin wings (*wg.*). × 20. 5. Thick-walled polygonal cells of sclerotesta. × 405.

micropyle of the ovule probably lies towards the axis of the cone.

The integument of the ovule is quite thick and measures 0·3-0·35 mm. At some places it is produced more or less into a ridge (PL. 1, FIG. 1; TEXT-FIG. 1). It is three-layered with a well-developed sclerotesta (PL. 1, FIG. 3), lined on both the sides by layers of fleshy tissue. Both the inner and outer fleshy tissue is composed of thin-walled cells, whereas the middle stony layer, which is very thick, is composed of thick-walled, polygonal cells with small lumen (TEXT-FIG. 5). The inner fleshy layer is quite clear and made up of a few layers of cells, whereas the outer fleshy layer could be detected only at two places where it appears to be composed of 1-2 layers of cells.

The *endosperm* is seen in patches only in some ovules. It is made up of thick-walled cells (PL. 1, FIG. 5). The embryo is not seen in any of the ovules.

As regards the vascular supply, nothing is known.

Diagnosis — Cone compact, 2-2·1 cm. in diameter, with spirally arranged overlapping scales. Cone-scales woody, thick in their middle region and expanded horizontally with their margins thinning out into wings; its double nature could not be known due to imperfectness of the cone; secretory sacs ? present in the scales. Ovules paired, 4·5 × 1 mm. in size, embedded in the scale, more or less horizontal and placed at a distance of 2-2·5 mm. from the apex of the scale; sometimes one ovule of a scale is larger than the other. Integument thick, 0·3-0·35 mm., three-layered with well-developed sclerotesta. Endosperm thick-walled. Embryo not seen.

Locality — Mohgaon Kalan in Chhindwara district of Madhya Pradesh.

Horizon — Deccan Intertrappean Series.

Type Specimen — B.S.I.P. No. 10650.

COMPARISONS AND DISCUSSION

The female conifer cone described here does not resemble with any of the cones so far described from the Tertiary rocks of India. *Indostrobus bifidolepis* Sahni (SAHNI, 1931, pp. 79-85) differs from the present cone in having two distinct terminal lobes in each ovuliferous scale, in the presence of tilted (45°) ovules, and the carinae in the sclerotesta of the integument which divide the ovules into two unequal halves. Also *I. bifidolepis* has membranous epimatium-like hoods arched over the ovules which are absent in the cone described here.

Takliostrobus alatus Sahni (SAHNI, 1931, pp. 85-92), known from Takli area in the Deccan Intertrappean Series, also differs from the present cone in deeply and irregularly corrugated surface of the wings, in the presence of a bract-scale fused to ovuliferous scale along the middle line throughout its length, but free laterally, and lastly in the distal limb of the ovuliferous scale being turned sharply upwards into a thin lamina.

The other female cone from Takli, ?*Pityostrobus crassitesta* Sahni (SAHNI, 1931, pp. 92-95) also differs from the Mohgaon cone, in having bigger seeds, in slightly more thickened seed integument, and in the absence (*see* SAHNI, 1931, PL. 15, FIGS. 101, 102) of large, thin wings like that of the present cone. However, ?*P. crassitesta* slightly resembles the present cone in the presence of ridges in the ovules. The ridges are conspicuous in only some ovules of the cone described above.

The present cone slightly resembles *Pityostrobus benstedi* (Mantell) Seward (SEWARD, 1919, pp. 386, 387, TEXT-FIG. 780; STOPES, 1915, pp. 130-134), an abietinean cone from the Lower Greensand of Kent, in possessing ovules embedded in the ovuliferous scales; but otherwise the two cones are quite distinct.

The important characters of the cone described above, viz. its compact nature with woody and spirally arranged cone-scales and the presence of two ovules in each ovuliferous scale, are the features which characterize the female cones of the family Abietineae. However, the presence of a distinct bract and an ovuliferous scale, as seen in the cone-scales of the members of Abietineae (COULTER & CHAMBERLAIN, 1910, p. 220) could not be ascertained in the present specimen as it represents only a portion slightly away from the cone-axis. Therefore, it may be said that the present cone shows resemblance in some characters with the ovuliferous cones of the modern abietineae and a definite conclusion regarding its true affinity can be drawn only on the discovery of further, complete and well-preserved material.

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EXPLANATION OF PLATE 1

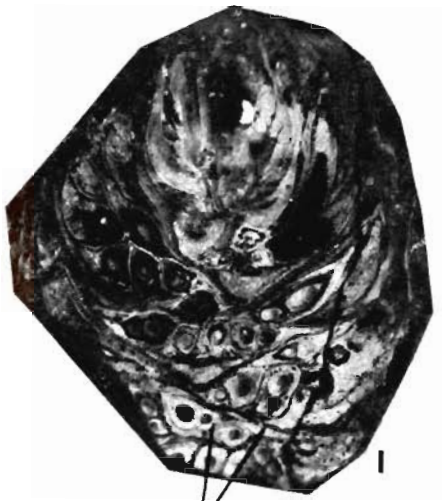
1. Tangential section of the cone from near the cone-axis. Note only one ovule in one of the scales (SC. 0). × 3.

2. Wing of a scale with few cavities (*c.*). × 72·5.

3. Another tangential section (slightly oblique) of the female cone. Sterile scales (*st. sc.*) are seen at the apex and a few among the ovuliferous scales (*ov. sc.*). *ov.*— ovule. × 2·5.

4. Tangential section of the cone away from the cone-axis. × 3.

5. A part of an ovule enlarged to show a patch of endosperm (*end.*) and sclerotesta (*scl.*) of the integument. × 175.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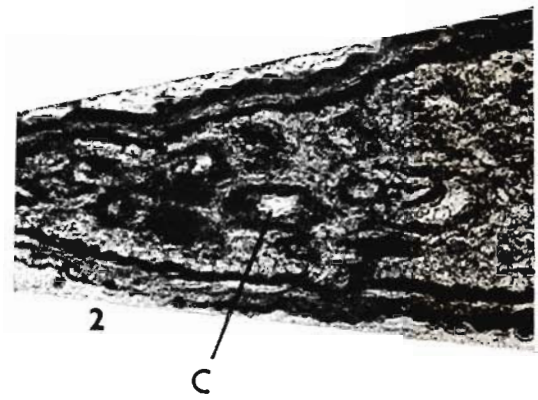
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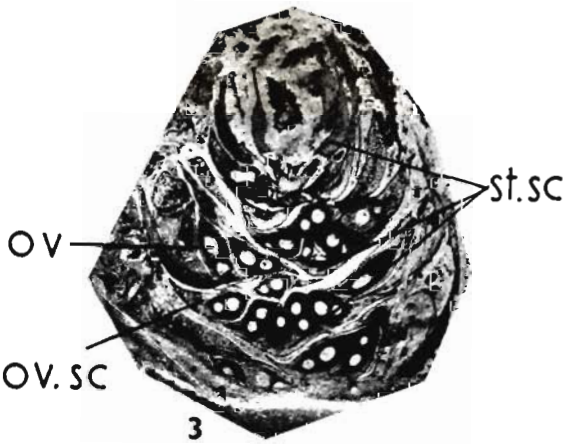
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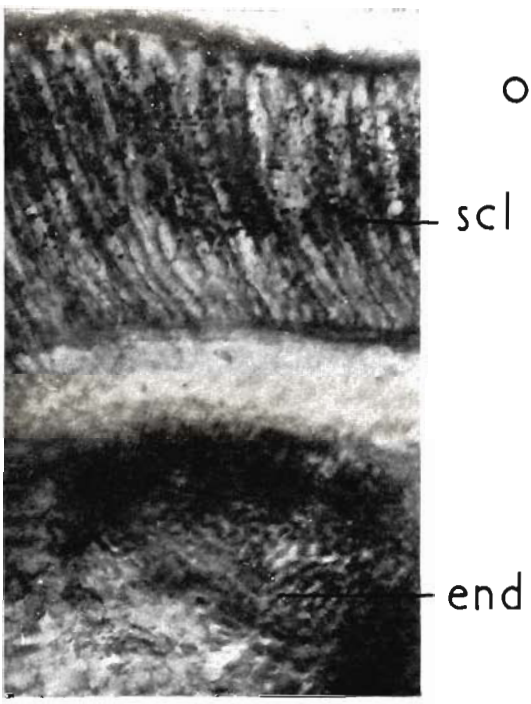
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