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# NEW FLORAL STRUCTURE FROM THE LOWER CRETACEOUS OF LAKE BAIKAL AREA

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ABSTRACT

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A new floral structure from the Baisa locality in the upper reaches of the Vitim River in Lake Baikal area is described as a gynoecium consisting of four ovulate appendages ("carpels") each bearing a single orthotropous ovule. It is supported and covered by linear-lanceolate bracts. The ovules contain *Ephedripites* pollen grains in the pollen chambers. This structure is compared with floral organs of gnetophytes and protoangiosperms.

## INTRODUCTION

Although Baisa, a well known locality of Early Cretaceous plants and invertebrates in the upper reaches of the Vitim River east of Lake Baikal was explored repeatedly, it is still capable of giving surprises. In 1962 it yielded an angiosperm-like leaf, *Dicotylophyllum pusillum* Vachrameev (Vachrameev and Kotova, 1977), in 1979 protoangiospermous *Baisia* (Krassilov and Bugdaeva, 1982) and in 1983 a fascinating floral structure described below. The latter was found by Dr. V.V. Zherikhin, a palaeoentomologist who contributed immensely to our knowledge of the Baisian fauna and flora.

A general description of the locality is given in Krassilov and Bugdaeva (1982). The new plant fossil came from a marl bed in the middle part of the section.

## SYSTEMATICS

### *Eoantha* Krassilov gen. nov.

*Name*: from *eos* — dawn and *anthos* — flower (Gr.).
*Type species*: *Eoantha zherikhinii* Krassilov, sp. nov.
*Diagnosis*: Floral structure consisting of four ovulate appendages radial on the axis which bears also linear-lanceolate bracts below and above the

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gynoecium. The ovulate appendages are wedge-shaped, showing a strong midrib and anastomosing transverse ribs. The ovules are orthotropous, one per appendage, showing a thinly cutinised integument, free nucellus, and conspicuously granular megaspore membrane. Polyplicate pollen grains of the form-genus *Ephedripites* occur systematically in the pollen chambers.

*Eoantha zherikhinii* Krassilov sp. nov. (Plate I, Plate II).

*Name*: after Dr. V.V. Zherikhin.
*Diagnosis*: as for the genus.
*Holotype*: Repository of the Institute of Biology and Pedology, N TB 15-600 (Plate I, 3).
*Description*: There are two impressions and their counterparts. In the holotype (Plate I, 3, 4) the four-parted gynoecium is spread rosette-like on the bedding plane. It is about 4 mm wide. The appendages are wedge-shaped, about 1.6 mm long, 1.8—2 mm wide, slightly concave, broadly rounded at the distal end, touching or slightly overlapping their margins. They seem flashy with a strong midrib appearing as a deep median groove filled with coaly crumbs. Transverse ribs arise from the midrib at right angle, diverge slightly. They are somewhat sinuous, showing infrequent forking and anastomosing. Grooves between the transverse ribs are sharp and narrow. Delicate longitudinal striation is seen under magnification. An ovule compression occurs on one of the appendages occupying its whole width. It is shown in Plate I, 4 intact and in Plate II, 1 cleared. Another appendage retained a half of the ovule split longitudinally (Plate II, 2). On the remaining two appendages, micropylar portions were found only near the apices.

Bracts spread radially around the gynoecium. They are linear-lanceolate, about 6 mm long, 0.8 mm wide at the base, attenuating to the apex. Large polygonal cells are seen on the bract impressions under low magnification. The bracts seem to underlie and overlap the gynoecium as if they arised below as well as above it.

The latter suggestion is confirmed by another specimen in which the axis lies along the bedding plane (Plate I, 1, 2). The axis is relatively massive, 1 mm thick, with partially permineralised vascular tissue showing in SEM tracheary elements with occasionally preserved pores (Plate I, 6). The axis rises above the gynoecial node at which only one appendage is seen intact,

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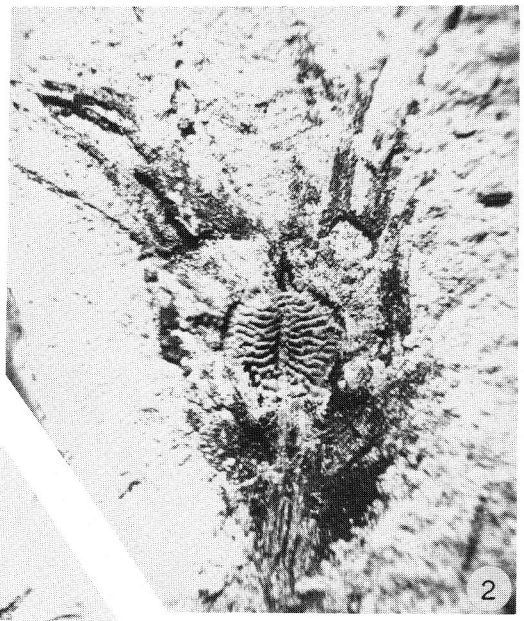
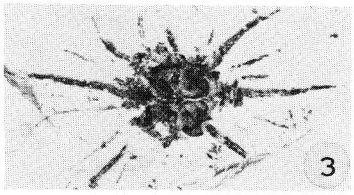
PLATE I

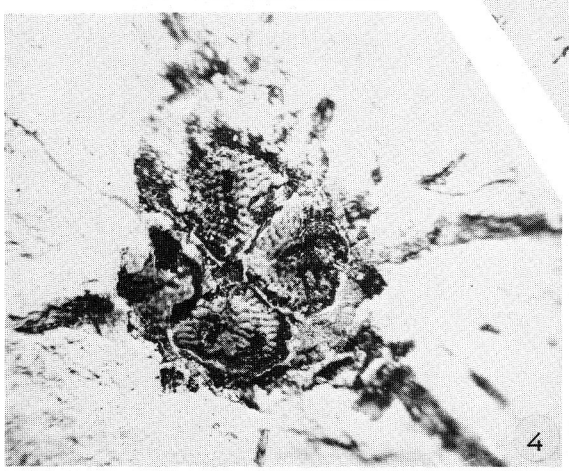
*Eoantha zherikhinii* sp. nov.

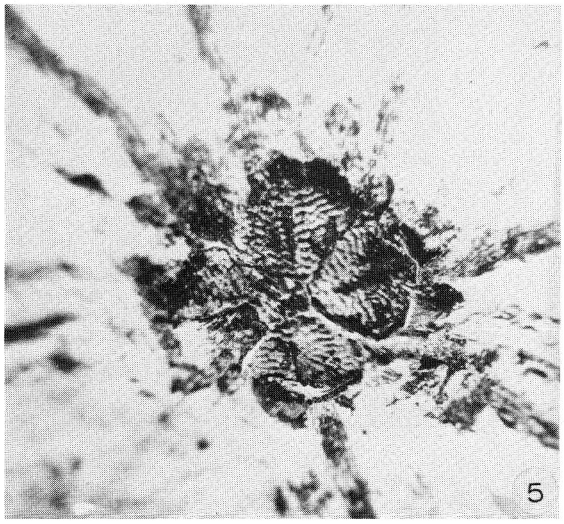
1, 2. Side view showing a relatively thick axis, one of the gynoecial appendages and spirally arranged bracts, × 3 and × 8.
3, 4. Front view aspect showing narrow bracts and four gynoecial appendages, one of them (left) with an intact ovule, × 3 and × 8.
5. Same, after the ovule was removed.
6. Vascular tissue from the axis of the specimen shown in Fig.2 with tracheary elements showing vestiges of the pores (arrow), SEM, × 1200.

PLATE I

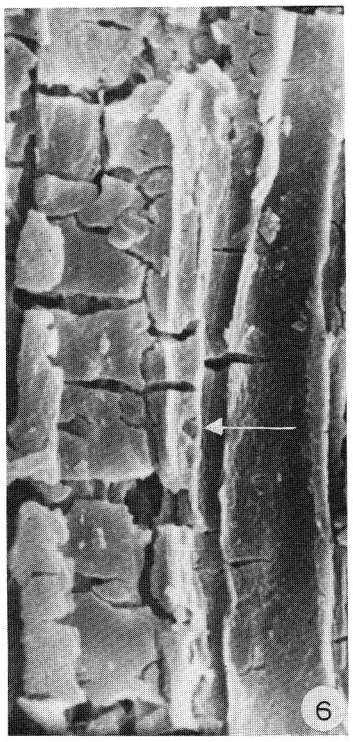
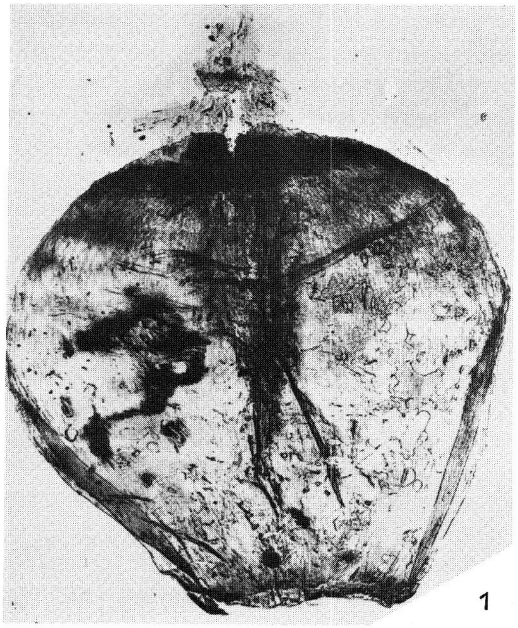
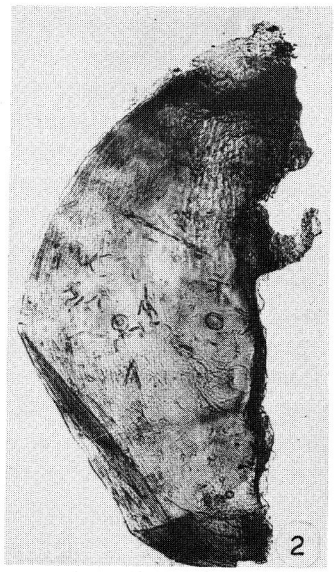



PLATE II



1



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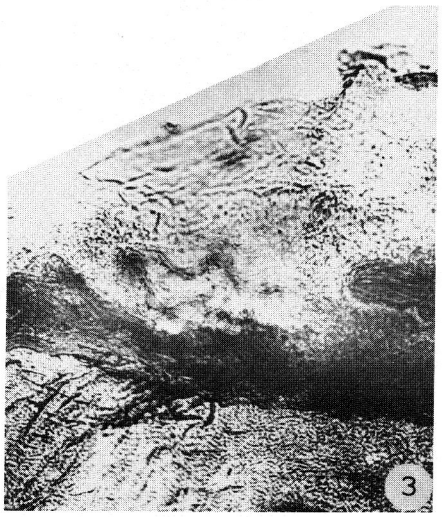

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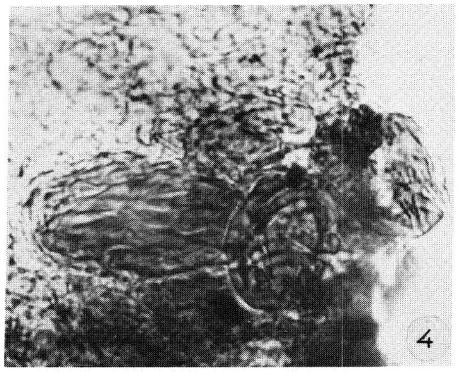

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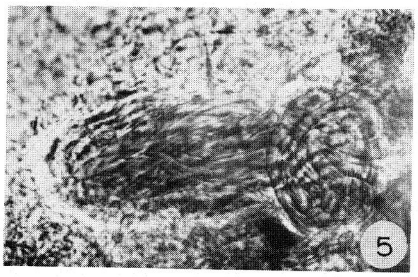

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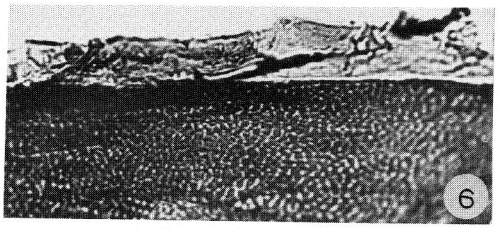

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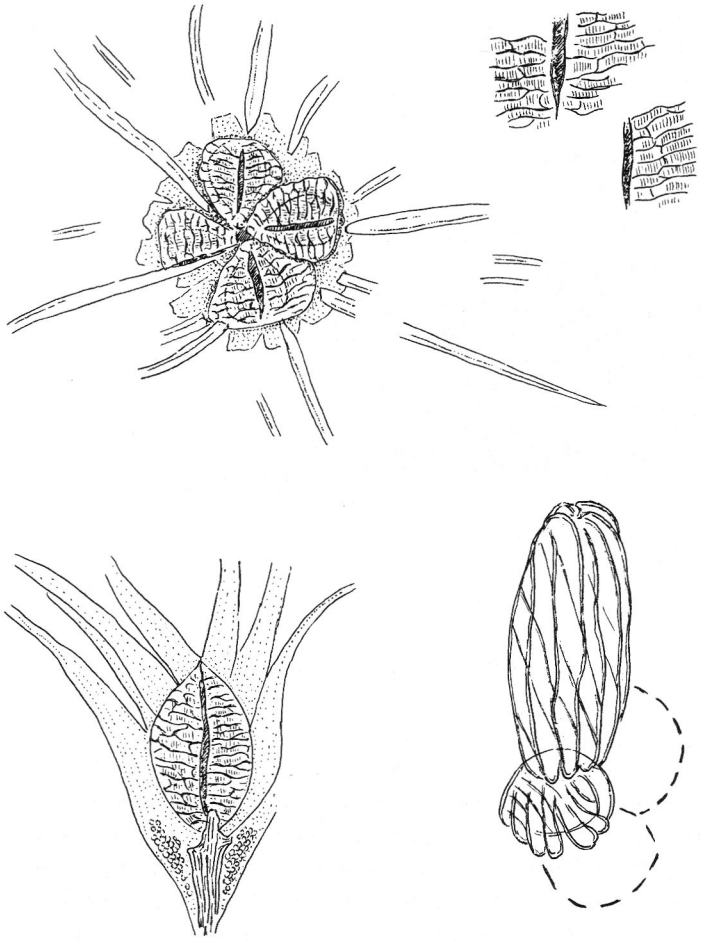

Fig.1. *Eoantha zherikhinii*, spread on the bedding plane (above) and in side view. Large polygonal cells are seen on the lower bracts. Top right: rib pattern on the fertile appendages. Bottom right: pollen grains from the pollen chamber.

while the positions of the others are marked by lateral vascular bundles from the axis. Bracts arise obliquely below and above the gynoecial node giving the specimen a bushy appearance.

The ovules are broadly obovate, obtuse, slightly concave at the chalazal

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PLATE II

1. Macerated ovule from the specimen shown in Plate I, 3 (left appendage) showing a broad nucellus and a micropylar tube, × 70.
2. A half of the ovule from another appendage with ovules in the pollen chamber, × 70.
3. Pollen chamber and the nucellar beak of the same specimen, × 165.
4, 5. Pollen grains in the pollen chamber, different focuses, × 600.
6. Granular membrane within the nucellus, × 165.

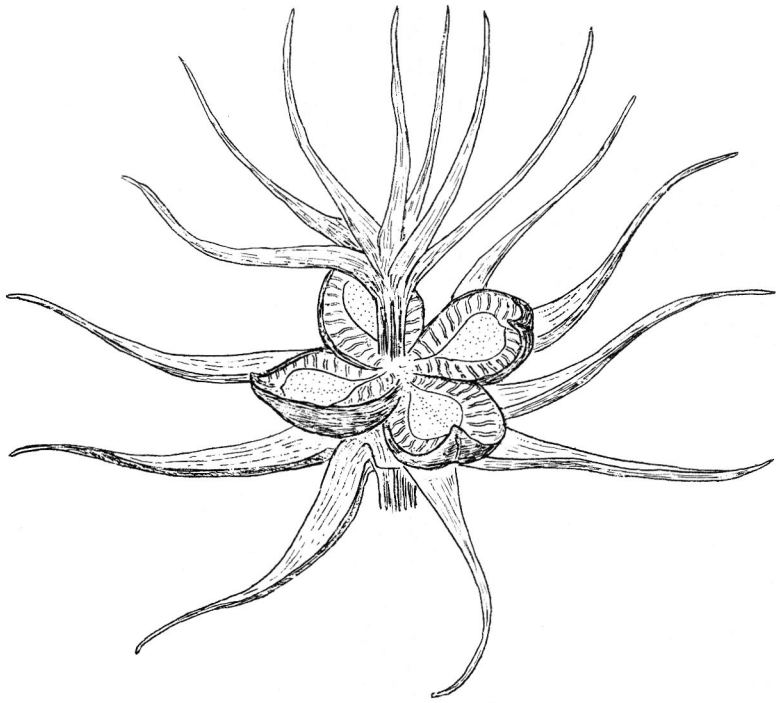

Fig.2. *Eoantha zherikhinii*, reconstruction.

end. Cleared ovule compressions show a single integument hardly more than 2 cells thick, thinly cutinised, forming a short micropylar tube about 112 $\mu$m long. The nucellus is broad, free to the base, showing elongate cells. Inside the nucellus there is a conspicuously granular megaspore membrane which extends up to the pollen chamber. The latter is low dome-shaped, with a vestigial beak.

Pollen grains occur in the pollen chambers of two ovules scattered or in small clusters, seen in equatorial as well as polar aspects. All of them are of the same type, elongate-elliptical, about 50 × 25 mm, obtusely pointed, polyplicate with 7—8 distinct ribs converging at the poles. The exoexine appears clefted between the ribs (Plate II, 4, 5).

## DISCUSSION

Though this plant is obviously gymnospermous as far as the mode of pollination is concerned, the gynoecial rosette surrounded by radially spreading bracts is flower-like. At the same time, projection of the bract-bearing floral axis above the gynoecium suggests reduction from some kind of strobilar structure.

The gynoecium consists of four appendages which can be compared with the bracts of *Welwitschia* supporting seed-scale complexes which look like

Fig.3. *Eoantha zherikhinii*, pollen grains in the pollen chamber, different foci, ×800 and 1000.

winged seeds. However, in *Welwitschia* the bracts are strongly concave and the striation pattern is longitudinal and slightly divergent. It is very unlike the deep median groove and anastomosing transverse ribs of the fossil floral appendages. Due to the latter features they resemble opened follicles of some ranunculaceous angiosperms showing relief venation of the locule wall. This being the case, the ovules should be held within the opened follicles by their funicles as in some members of the Magnoliaceae.

The pollen grain morphology indicates some relationships with gnetophytes. They correspond to the current concept of the pollen-genus *Ephedripites* which, according to Balme (1970), is distinguishable from *Gnetaceaepollenites* by better defined regular ribs and a generally denser exoexine which appears structureless or faintly granulate. Longitudinal clefts in the exoexine are described in *Gnetaceaepollenites* and extant *Welwitschia*.

Hitherto pollen grains of this kind were not attributed to any macrofossils. They might have been produced by some Paleozoic pteridosperms and retained in extant gnetophytes as well as in the Mesozoic transitional forms.

Gnetophytes of extant morphology are not known from the Mesozoic, though, in the present author's opinion (Krassilov, 1982) the samaras of *Hirmeriella* bearing ovules enclosed within the cuticle-lined locules resemble corresponding organs of *Welwitschia* rather than any coniferous seed-scales with which they were conventionally compared. Plants with the *Hirmeriella*-type ovulate organs and *Corollina* (*Classopollis*) pollen grains might represent an extinct order of the gnetophytes. *Eoantha* is another candidate but its follicle-like gynoecial appendages suggest affinities with protoangiosperms or some transitional forms between them and gnetophytes.

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