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Upper Cretaceous staminate heads
with pollen grains

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UPPER CRETACEOUS STAMINATE HEADS WITH POLLEN GRAINS

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ABSTRACT. *Tricolpopollianthus burejensis* gen. et sp. nov., the staminate heads with tricolpate grains *in situ*, are described from the Upper Cretaceous of the Amur Basin, Far East of the U.S.S.R.

DIFFERENT types of angiosperm pollen grains of obscure affinities have been described from Upper Cretaceous and Palaeogene deposits. The discovery of pollen grains within the pollen-bearing structures is of interest in linking the angiosperm mega- and microfossils. Unfortunately, angiosperm fossil flowers are extremely rare. Few fossil flowers with pollen grains have been reported from the Tertiary of Europe and the staminate heads described in this paper are the only ones known so far from the Cretaceous. They have been collected (Krassilov 1971) from the Tsagajan Formation near the mouth of the Bureja River, a tributary of the Amur. The Tsagajan Formation is composed of conglomerates, gravels, and sands containing fossiliferous clay and siltstone lenses. These rocks are of alluvial origin. Dinosaur remains have been collected from the beds somewhat older than the plant-bearing strata. Plant megafossils from Tsagajan Beds have been described by Heer, Kryshstofovich, Baikovskaya, and others. Kryshstofovich (in Kryshstofovich and Baikovskaya 1966) assigned the Tsagajan fossil flora to the Danian stage whereas Bratzeva (1969) advocated a Maastrichtian age on the plant microfossil evidence. The Tsagajan flora comprised about 60 species of conifers and angiosperms. This fossil assemblage was dominated by *Sequoia* and *Trochodendroides* and represented a lowland-valley forest of temperate aspect.

Methods. Balsam transfer preparations of heads have been prepared and the stamen fragments have been macerated with HNO₃ and KOH.

SYSTEMATIC DESCRIPTION

Genus TRICOLPOPOLLIANTHUS gen. nov.

Diagnosis. As for species diagnosis below.

Tricolpopollianthus burejensis sp. nov.

Plate 3, figs. 1-13

Diagnosis. Staminate heads, globular, 7-8 mm in diameter borne singly or in spikes. Stamens with inconspicuous filaments and long anthers. Connective distally expanded. Pollen small, tricolpate.

Holotype. Specimen 571-331 and slide 571-331a, Far East Geological Institute Collections; Pl. 3, figs. 4, 7.

[Palaeontology, Vol. 16, Part 1, 1973, pp. 41-44, pl. 3.]

Occurrence. Right bank of the Bureja River near the bottom of Belaja Mountain, Tsagajan Formation.

Age. Maastrichtian–Danian.

Description. There are five heads of uniform size (7–8 mm in diameter). Only short pieces of peduncle (or spike axis) preserved. Peduncle about 1 mm thick. Receptacle relatively massive. Individual flowers not distinguishable. Stamens in surface view are seen in split heads (Pl. 3, figs. 2–3). They are about 3 mm long, 0.8 mm wide, distally expanded in a shield with leaf-like process. The latter triangular, often curved or reflexed. Two ridges below the distal expansion of connective represent pollen sacs. On imprints of head surface, distal expansions of stamens are seen as polygonal shields 1 mm wide (Pl. 3, figs. 1, 4–6). Cuticle of connective delicate. Cells elongated, with straight walls. Stomata were not observed.

Masses of pollen grains adhere to stamen and connective cuticles. It was difficult to separate the individual pollen grains and they have been photographed lying on the cuticle. Pollen tricolpate, spherical, trilobate in polar view, elliptical in equatorial view. Diameter 18 μm , equals the polar axis. Exine *c.* 1 μm thick, ectexine clavate-microreticulate. Colpi long, almost reaching the poles.

Remarks. *Tricolpopollianthus* stamens may be compared with those of *Nymphaea*, some members of the Magnoliaceae, and to some extent, with *Platanus* and *Nelumbo*, which have distally expanded connectives. However, if this interpretation of *Tricolpopollianthus* morphology is correct, it differs from the staminate structures of these modern genera.

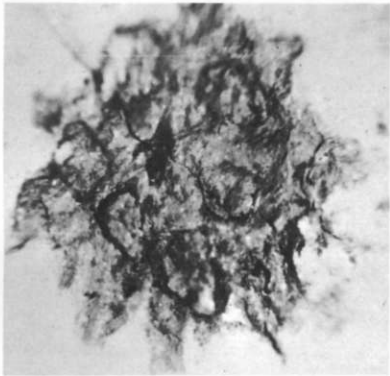
Pollen grains resemble *Tricolpopollenites micromunus* Groot et Penny which have been reported from several Upper Cretaceous and Lower Tertiary localities in Asia and North America (see Drugg 1967). Brenner (1963, p. 93) compared *T. micromunus* with pollen grains of living *Trochodendron*. Similar pollen grains were obtained from the staminate heads assigned to the Tertiary *Platanus neptuni*; Bužek *et al.* (1967) compared these pollen grains with *Tricolpopollenites microhenrici*.

According to Chang (1964) the pollen grains of *Platanus* are tricolpate, spherical, 18.5–22.5 μm in diameter, with ectexine microreticulate. However, they differ from the pollen grains of *Tricolpopollianthus burejensis* in comparatively short and broad colpi. The pollen grains of *Trochodendron aralioides* Sieb. et Zucc. differ from those of the present species in more elongate form (polar axis up to 26 μm , diameter 20 μm) and in having larger meshes of the exine reticulum. *Corylopsis pauciflora* Sieb. et Zucc. has comparable but somewhat larger pollen grains.

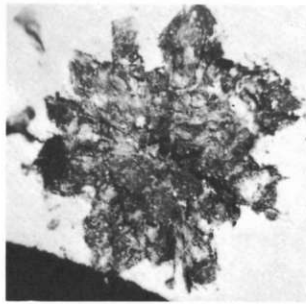
Tricolpopollianthus supplements the record of Cretaceous angiosperm reproductive structures which are mostly unisexual, devoid of conspicuous perianth, and clustered in spikes, racemes, or heads. It illustrates the primitive type of stamen retained with some modifications in several living genera.

EXPLANATION OF PLATE 3

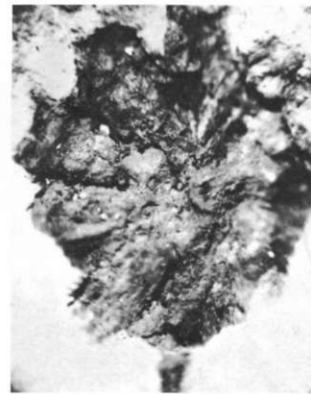
Figs. 1–13. *Tricolpopollianthus burejensis* sp. nov.; staminate heads with pollen grains from the Upper Cretaceous of the Bureja River. 1, 5–6, Heads showing distal expansions of stamens, $\times 7$. 4, Part of fig. 1, $\times 12$. 2–3, Split heads showing stamens, $\times 7$. 7, Pollen grains on the connective cuticle, $\times 395$. 8–13, Pollen grains, $\times 1000$.



1



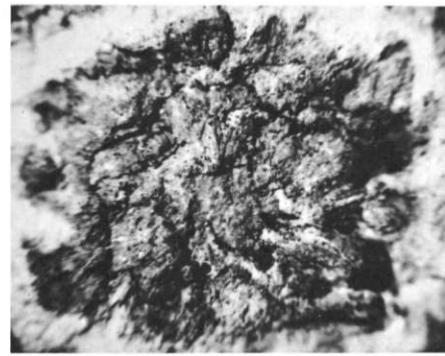
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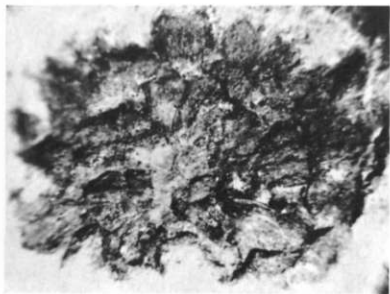
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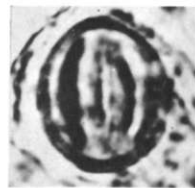
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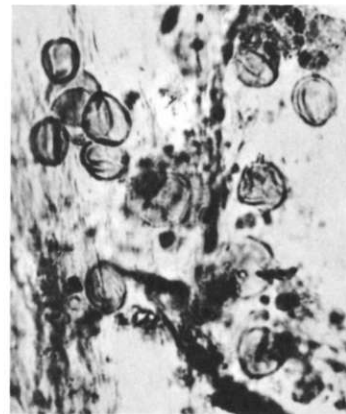
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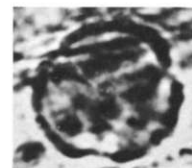
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13

KRASSILOV, Cretaceous flower with pollen

