Palaeobiology

The Pollen of Genus *Alangium* in Cenozoic Deposits of Georgia

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(Presented by Academy Member David Lordkipanidze)

ABSTRACT. In geological records the genus *Alangium* is known from the Paleogene. Morphologically different pollen grains were determined in the Eocene deposits of both hemispheres: the pollen of *Alangium* sp. A in North America, *Alangiopollis eocaenicus* Krutzsch in Europe and *Alangium sibiricum* Lubomirova in the Western Siberia. The species *A. barhoornianum* Traverse was described from the Upper Oligocene Brandon lignite of Vermond (North America). The same pollen grains were revealed in Europe. The European pollen remains were similar to Traverse’s *Alangium barhoornianum* and only the generic name was changed. On the territory of Europe the species *Alangiopollis barhoornianum* (Traverse) Krutzsch is known mainly from the Paleogene till the Middle Miocene. Approximately in the same interval of time the species *A. simplex* Nagy and *A. rarus* Cernjavska were determined. On the territory of Georgia the genus *Alangium* is also known from Paleogene. The species *Alangiopollis eocaenicus* was described from the Middle Oligocene deposits of Southern Georgia. In Sarmatian the genus was represented by two species *A. eocaenicus* and *A. barhoornianum*. After Sarmatian the history of *Alangium* was connected only with the area adjoining the Black Sea, where the accumulation of marine deposits continued during the whole Pliocene and Pleistocene. In Meotian the pollen grains of two species were determined - the extinct taxon *A. simplex* and the recent *Alangium kurzii* Craib, which were preserved in composition of flora during Plioene and Lower Pleistocene (Gurian). After Gurian the genus *Alangium* fully became extinct on the territory of Georgia. © 2014 Bull. Georg. Natl. Acad. Sci.

Key words: Georgia, Cenozoic, pollen grains, genus *Alangium*.

At present *Alangium* is the single genus of the family *Alangiaceae*. In its composition there are about 20 species, united in 4 sections: Conostigma, Alangium, Marlea and Rhytidandra. There are evergreen trees, shrubs and lianas, whose area is connected to south-eastern part of Asia (India, China and Japan), Africa and the islands of Pacific. *Alangium platanifolium* is the only deciduous species and its range includes regions of temperate to cold-temperate, continental climatic conditions [1]. *Alangium* pollen grains are characterized by great diversity. The morphology of 13 species was studied by Eramian [2]. Two types of grains were distinguished on the basis of pollen shape and character.

of colpi: type Alangium and type Marlea. The latter was divided into two subtypes: Alangium ridleyi and A. vitiense. According to some scientists, in connection with great variation of pollen grains and overlapping characters found in four sections, the pollen of Alangium cannot be sharply separated into “types” and “subtypes” [1].

In Europe the most ancient pollen grains of Alangium are described from Eocene deposits of Germany under the name Alangiopollis eocaenicus Krutzsch [3]. The author compared it with Alangium griselloides Capuron, whose recent area is limited by Madagascar. A. eocaenicus possesses signs characteristic of some pollen types and its pollen can only approximately be compared with Alangium chinense type A [4]. The pollen grains of Alangium sp. from London Clays are also referred by this author to A. eocaenicus. According to Eyde [5], “Reitsma’s claim that the London Clay pollen conspecific with A. eocaenicus from various German localities is not based on a direct comparison of specimens and therefore should be treated cautiously; photos show that British fossil is quite similar to German fossils, but there appears to be a substantial difference in size”. At the same time Eyde recognizes that both A. eocaenicus and London Clay pollen have coarse reticulation.

The species Alangium sibiricum Lubomirova was described from the Eocene deposits of Western Siberia [6]. The author compared it with A. javanicoides Cookson [7] from the Upper Pliocene deposits of New Guinea or with its modern analogue A. javanicum (Blume) Wangerin.

In 1992 Nagy referred pollen grains of Alangium sibiricum to the unidentified plant, known in literature as Tricolporopollenites wackersdorferensis Thiele-Pfeiffer [8] or Fupingopollenites wackersdorferensis (Thiele-Pfeiffer) Liu Geng-wu [9]. A new taxon was described under the name Tricolporopollenites sibiricum (Lubomirova) Nagy et n.comb. [10], which now is used by palynologists of Europe [11].

The question about renaming of A. sibiricum was discussed in the articles, devoted to the history of genus Fupingopollenites on the territory of Georgia [12, 13]. There are two main differences between pollen grains of A. sibiricum and Fupingopollenites. The first is the absence of exine thickening around the pores on the pollen grains of Fupingopollenites. According to Lubomirova it is the main feature of A. sibiricum, which differs it from other species of this genus and bring it near to A. javanicoides. The second difference is the absence of “concave plate-like thinning areas of exine” typical for Fupingopollenites on the pollen grains of A. sibiricum (Fig. 1).

From the Upper Eocene deposits of North America the species Alangiopollis sp. A was determined [14]. The second species Alangium barghoornianum Traverse was described from the Upper Oligocene Brandon lignite, a small brown coal deposit in Central Vermont [15].

Two opposite opinions were expressed about the age of Brandon deposit [1]. The first is based on the

Fig. 1. Comparison of Alangium sibiricum (a, collection of Lubomirova) with pollen of Fupingopollenites wackersdorferensis (b) from Upper Miocene deposits of Georgia.
similarity of Brandon fossil fruits *Alangium vermontanum* Eyde & Barghoorn to Miocene fruits of Salzhausen (Germany) that allows thinking about the Miocene age of the Brandon deposit. The second opinion about the upper Oligocene age suggested for Brandon flore is based on pollen remains.

Traverse compared the pollen grains of *A. barghoornianum* to recent *A. chinense* (Lourielo) Harms. At the same time, another opinion exists that there are other species in section Marlea, to which the fossil can be compared [1]. At first it was compared to *A. platanifolium* because of the striate surface pattern common to both. But a more careful comparison of the second *Alangium* grain in Brandon material revealed that the resemblance is only superficial. The ridged surface pattern in the exine of *A. platanifolium* is underlain by a reticulum, independent of the overlying ridges, which is completely absent in Brandon fossils. On the basis of this difference the conclusion was made that the nearest modern counterpart to the Brandon grains is the species *Alangium kurzii* Craib, a palynologically variable species. According to Reitsma [4], *Alangium barghoornianum* was the parent taxon, divided into two recent species *A. kurzii* and *A. platanifolium*.

In Europe the pollen grains similar to *A. barghoornianum* were discovered in the Tertiary deposits of Germany. The five localities were listed by Krutzsch [16]. Two of them belong to the Lower Miocene and the others - to the Middle Oligocene. The European remains were so similar to Traverse’s *A. barghoornianum* that only the generic name was changed and pollen grains were described as *Alangiopollis barghoornianum* (Traverse) Krutzsch. Krutzsch also noticed the resemblance of his German fossils to pollen of *Alangium kurzii*.

On the territory of Central Europe the pollen grains of *Alangiopollis barghoornianum* are presented mainly in deposits beginning from the Middle Oligocene till the Middle Miocene [17-20]. Besides, from the Helvetian deposits of Hungary the pollen

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Tab. 1. Stratigraphical division of the Black Sea Upper Cenozoic deposits [26]

<table>
<thead>
<tr>
<th>Cenozoic</th>
<th>Neogene</th>
<th>Miocene</th>
</tr>
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<tbody>
<tr>
<td>Quaternary</td>
<td>Upper</td>
<td>Kuyalnician 3.40 Ma</td>
</tr>
<tr>
<td></td>
<td>Lower</td>
<td>Kimmernian 5.2 Ma</td>
</tr>
<tr>
<td></td>
<td>Upper</td>
<td>Pontian 7.0 Ma</td>
</tr>
<tr>
<td></td>
<td>Middle</td>
<td>Meotian 9.3 Ma</td>
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<td></td>
<td></td>
<td>Sarmatian 13.7 Ma</td>
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<td></td>
<td></td>
<td>Chaudian 0.73 Ma</td>
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<tr>
<td></td>
<td></td>
<td>Gurian 1.67 Ma</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.50Ma</td>
</tr>
</tbody>
</table>

Fig. 2. The species of *Alangium kurzii* recent area [4].
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grain of *A. (Alangiopollenites) simplex* Nagy was described [18,19]. According to the author, this species morphologically reminds recent *Alangium chinense* (Lour.) Harms. *Alangiopollis rarus* Cernjavska from the coalbearing Paleogene deposits of Bulgaria is the other species, which distinctly stands out from *A. barghoornianum* [21].

The species *Alangium barghoornianum* (Trav.) Tarasevicz was described from the Miocene deposits of Russian Plain [22]. According to the author, morphologically and biometrically pollen grains are similar to *Alangiopollis barghoornianum*.

The fossil pollen grains close to recent species *Alangium chinense*, *A. cf. javanicum* and *A. cf. scandens* Bloumb. were described from the Pliocene deposits of VietNam [23].

Most of the fossil pollen grains belong to section Marlea, which occupied Europe and North America in the Tertiary. The plants of sections Conostigma, Alangium and Rhytidandra never extended very far beyond their present ranges [1]. But the presence in Eocene deposits of Siberia the pollen grains of *Alangium subiricum* similar to *A. javanicum* somewhat changes this hypothesis.

In Georgia’s fossil floras the genus *Alangium* is known only by pollen data [24]. The first finds are connected to location of the Middle Oligocene macroflora of Tori (Southern Georgia). The pollen grains were determined as *Alangiopollis eocaenicus*.

Sarmatian is the following stretch of time, whose deposits contain the remains of *Alangium*. In composition of flora the genus was represented by two species: *Alangiopollis eocaenicus* and *A. barghoornianum*. The single pollen grain of this taxon was first determined as *Alangium aff. kurzii* [25]. But after more detailed study of new material from Sarmatian deposits of Eastern and Western Georgia it was renamed as *Alangiopollis barghoornianum*. Morphologically the pollen grains are more similar to those from the deposits of Southern part of Europe, Hungary and Slovakia [18, 21].

The end of the Middle Sarmatian was the turning...
point in the Neogene history of Georgia. As a result of orogenic movements the Transcaucasian intermountain depression transformed into dry land, divided into two parts by the Dzirula massif. To the east of the Dzirula massif the Kura bay was formed. In the Late Sarmatian the territory of Georgia adjoined this bay became dry land with the landscape typical to the continental climate. In the west the Rionian Bay originated, where marine deposits continued to accumulate till the end of the Pleistocene. Now the Western Georgia is the stratotypical region where the Black Sea Upper Cenozoic is represented in full series of deposits (Tab. 1). So, after the Sarmatian the comparative complete history of Georgia’s flora can be reconstructed only on the basis of fossil material from the Western Georgia.

In the Meotian the genus *Alangium* was represented by extinct species *Alangiopollis simplex* and the recent *Alangium kurzii*. In deposits of the following stages the pollen grains of *Alangiopollis simplex* were not seen. In the Pliocene on the territory of Western Georgia only one species *A. kurzii* was preserved. Especially great number of grains was seen in Duabi layers, to which the famous Duabian macroflora is connected [27]. It was the last stretch of time, when on the territory of Western Georgia in lower mountain belt the subtropical vegetation existed as the independent community.

In the Kuyalnician and Lower Gurian on the territory of Western Georgia the predominance of rich polydominant deciduous forest began, which occupied the lower and middle mountain belts. The Pliocene relicts had rather big part in its composition. The following Late Gurian time was the transitional period, when the vegetation of Western Georgia began to lose the features, typical for the
Neogene, and obtained the signs, characteristic of the Quaternary. The polydominant forest divided into some communities, which distributed along the separate mountain zones. In middle mountain belt the formation of oligomonodominant beach communities began. The lower mountain belt was occupied by mixed forest, where the bulk of thermophilous plants were concentrated. In Upper Gurian there were also big changes in the character of flora, where a great number of Pliocene relicts became extinct including the species *Alangium kurzii*, whose recent area ranges from Java to China (Fig. 2).
REFERENCES


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