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The Pollen of the Genus *Fupingopollenites* in the Cenozoic Deposits of Georgia

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ABSTRACT. The work is devoted to the history of an angiosperm plant of indeterminate botanical affinity on the territory of Georgia. In the fossil material it is known by pollen grains, which are distributed in the Cenozoic deposits of Eurasia and described under different names. © 2009 Bull. Georg. Natl. Acad. Sci.

Key words: Georgia, Cenozoic deposits, pollen grains, Fupingopollenites.

From time to time photos and descriptions of pollen grains of an angiosperm plant of indeterminate systematical position appear in the literature. This unknown pollen is distributed in the Cenozoic deposits of Eurasia (Fig.) and is described under different names: *Pollenites edmundii, Pollenites* sp. [1], *Dacrydium guillaumini, Dipterocarpacearumpollenites hidasensis* [2, 3], "Unknown tricolporate pollen" [4, 5]. All these forms were united in one taxon - *Tricolporopollenites wackersdorfensis* Thiele-Pfeiffer [1]. Then in Tertiary deposits of China Liu Geng-wu [6] established a new genus – *Fupingopollenites* sp., *F.imbecillus* Liu Geng-wu, *F.minutus* Liu Geng-wu and *F.wackersdorfensis* (Thiele-Pfeiffer) Liu Geng-wu [6].

In Georgia the pollen of an unknown angiosperm plant at first was described from Upper Miocene deposits of the western part of the country [7, 8]. The pollen grains were similar to species *Tricolporopollenites* wackersdorfensis Thiele-Pfeiffer or to its synonym *Fupingopollenites wackersdorfensis* (Thiele-Pfeiffer) Liu Geng-wu. As the name of the first taxon was proposed earlier we used it for the pollen from Upper Miocene deposits of Western Georgia. In recent years we obtained new palynological material from Cenozoic deposits of Eastern Georgia, in the composition of which pollen grains of an unknown angiosperm plant were found. The pollen from Eocene deposits was similar to *Tricolporopollenites wackersdorfensis* or *Fupingopollenites wackersdorfensis*.

In Sarmatian deposits, besides the latter, pollen grains similar to species of the genus *Fupingopollenites minutus* Liu Geng-wu were also seen. Hence, we decided to associate the whole fossil material in one genus *Fupingopollenites*, which in Sarmatian flora of Georgia was represented by two species: *F.wackersdorfensis* (Thiele-Pfeiffer) Liu Gengwu and *F.minutus* Liu Geng-wu.

The pollen grains of the genus *Fupingopollenites* are subspherical to spherical, of medium to large size, tricolporate, colpi narrow and straight. In all descriptions the authors note that the pores are poorly seen. Liu Geng-wu names them "inner pores" which are visible only under right polar or equatorial view. The exine is columellate. The columellae are long and thick at the angles in equatorial contour and much thinner around the apertures. The characteristic feature of grains is the presence of "concave plate-like thinning areas" on pollen surface [6].



Fig. The distribution of pollen of the genus Fupingopollenites on the territory of Eurasia during the Cenozoic.

The botanical affinity of *Fupingopollenites* remains unknown although some authors consider it as *Verbenaceae*, *Boraginaceae*, *Caesalpiniaceae* [1, 4, 9]. Liu Geng-wu [6] compares *Fupingopollenites* with *Scabiosapollis* Sung et Zheng and *Convolvulus*.

In our opinion the pollen grains of *Fupingopollenites* have some similarity with the pollen of *Alangium*, especially with the species which have no recent analogues. The similarity is mainly observed in the character of columella, changeable in length and thickness, increasing from center to periphery of pollen grain. The pollen of *Alangium* sp., from Oligocene deposits of Southern Georgia has such sculpture (Plate, Fig.11). Another grain with such sculpture, determined as *Alangium simplex* Nagy, was found in the Maeotian deposits of Western Georgia (Plate, Fig.12).

By shape and size the grains of Fupingopollenites are also similar to Alangium sibiricum Lubomirova [10] from Eocene deposits of Western Siberia (Plate, Fig.13). The main difference is the absence of strong thickening of exine around the pores on the pollen grains of Fupingopollenites. According to Lubomirova, that is the main feature of Alangium sibiricum, which differs it from other species of this genus. Pollen grains of Alangium sibiricum, as the pollen of the above-mentioned other species of this genus, has no "concave platelike thinning areas" typical of Fupingopollenites. In spite of this fact, Nagy [11] referred the pollen grains of Alangium sibiricum to an unknown angiosperm plant which she described as Tricolporopollenites sibiricum (Lubomirova) Nagy. Earlier, on the basis of Nagy's personal information, this species was described by

Planderova [12].

The plant producing the pollen grains like *Fupingopollenites* lived in the subtropical humid climate and was a component of evergreen formation. The genus originated in the Middle Eocene, when the territory of its distribution was restricted to China. In the Oligocene it began to develop, and in the Miocene reached highly prosperous periods. The distribution area rapidly increased covering most non-arid middle latitude territory of Asia [6].

On the territory of Europe Middle Oligocene deposits are the oldest in which pollen grains of unknown angiosperm were seen. The species *Tricolporopollenites sibiricum* (Lubomirova) Nagy attained culmination of development in the Middle Miocene (Badenian), after which it occurs in deposits by one or two specimens [11]. The Lower Quaternary sediments of the Mediterranean Sea are the youngest, which contain pollen similar to *Fupingopollenites*. It was seen in two samples, which "have a northern pollen record, among which deciduous thermophile trees and Tertiary relics reach their highest percentage" [4]. The author concludes that this unknown pollen could also be a Tertiary relict.

So, in Georgia *Fupingopollenites* is known from the Eocene deposits, where it is represented by single pollen grains. We have no data about the Oligocene, Lower and Middle Miocene, but it is doubtless that this genus was in the composition of flora during this time. *Fupingopollenites* achieved a highly prosperous period in the Sarmatian, when it was represented by two species: *Fupingopollenites wackersdorfensis* (Thiele-Pfeiffer) Liu Geng-wu and *F.minutus* Liu Geng-wu. We



Plate. 1 - Fupingopollenites wackersdorfensis (Thiele-Pfeiffer) Liu Geng-wu from Eocene deposits of Western Georgia; 2 - F wackersdorfensis from Sarmatian deposits of Eastern Georgia; 3-7-F.wackersdorfensis from Sarmatian deposits of Western Georgia; 8-10 - F. minutus Liu Gengwu from Sarmatian deposits of Eastern Georgia; 11- Alangium sp. from Middle Oligocene deposits of Southern Georgia (the collection of Kh.Purtseladze); 12 - Alangium aff.simplex Nagy from Maeotian deposits of Western Georgia; 13 -A. sibiricum Lubom. from Palaeogene deposits of Siberia (the collection of K.Lubomirova); x1000.

suppose that this plant was the component of rich polydominant forest, which in the Lower and Middle Sarmatian was the dominant formation on the whole territory of Georgia. The subtropical and warm-temperate conifer and leaf-bearing trees and ferns were in its composition. For the majority of them the Sarmatian was the time of highest development, after which the process of extinction began, its rate depending on many biotic and abiotic factors.

After the Middle Sarmatian the territory of Western Georgia turned into an isolated region where in the lower mountain belt subtropical climate continued to preserve. Here mass extinction of Miocene thermophilous plants was connected with the boundary between the Miocene and Pliocene (Maeotian/Pontian), when a sharp decrease of humidity took place. As a result, many subtropical plants disappeared from the composition of flora. Among them were the representatives of genus *Fupingopollenites*, whose fossil remains are unknown in Pliocene deposits. The mass extinction of Miocene subtropical plants happened earlier on the territory of Eastern Georgia than in Western Georgia. This phenomenon was connected with huge orogenic movements, which took place in the Caucasus after the Middle Sarmatian. As a result the sizes of marine basin reduced; nearly the whole territory of Kartli and Kakheti transformed into dry land with continental climate; the forest vegetation was superseded by herbaceous communities or open woodlands. Thus, for the Sarmatian deposits of Eastern Georgia the pollen of the genus *Fupingopollenites* can be considered as an index fossil.

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პალეობიოლოგია

გვარ Fupingopollenites-ის მტვრის მარცვლები საქართველოს კაინოზოური ნალექებიდან

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ნაშრომი ეძღვნება უცნობი ფარულთესლიანი მცენარის ისტორიას საქართველოს ტერიტორიაზე. ევრაზიის კაინოზოურ ნალექებში იგი წარმოღგენილია მტვრის მარცვლების საზით, და აღწერილია სხვადასხვა საზელწოდებებით: Tricolporopollenites wackersdorfensis Thiele-Pfeiffer, Fupingopollenites wackersdorfensis Liu Geng-wu.

საქართველოში ამ მცენარის მტვრის მარცვლები პირველად განსაზღვრულ იქნა როგორც Tricolporopollenites wackersdorfensis Thiele-Pfeiffer. იგი ერთადერთი სახეობა იყო დასავლეთ საქართველოს ზედამიოცენურ პალინოსპექტრებში. მოგვიანებით იგივე ფორმა აღმოჩენილ იქნა აღმოსავლეთ საქართველოს ეოცენურ და სარმატულ ნალექებშიც. სარმატულ პალინოკომპლექსებში ნანაზი იქნა მეორე სახეობაც -Fupingopollenites minutus Liu Geng-wu. ამის შემდეგ საჭირო გაზდა ორივე მათგანის გაერთიანება ერთ გვარში – Fupingopollenites.

საქართველოს ტერიტორიაზე გვარი Fupingopollenites განვითარების კულმინაციას სარმატულში აღწევდა. დასავლეთ საქართველოში კოლხეთის რეფუგიუმის ტერიტორიაზე, სადაც ჰავა სარმატულის შემდეგაც თბილი და ნოტიო იყო, ეს მცენარე ფლორის შემადგენლობაში მიოცენურის ბოლომდე იქნა შენარჩუნებული. ადმოსავლეთ საქართველოს ტერიტორიაზე იგი გადაშენდა შუასარმატულის შემდეგ, როდესაც ტყის მცენარეულობის არეალი შემცირდა და დაიწყო კონტინენტური ჰავის ბალახოვანი ფორმაციების გაბატონება.

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