Acta Biologica Szeged 16 (3—4), pp. 63—72 (1970)

PROBLEMS OF CRETACEOUS-PALAEOGENE PALAEOPHYTOGEOGRAPHICAL REGIONS BASED ON PALYNOLOGICAL RESULTS II.

M. KEDVES and EMŐKE KIRÁLY

Department of Botany Attila József University, Szeged

(Received February 7th 1969)

Introduction

In our preceding work (M. KEDVES and EMŐKE KIRÁLY, 1968) we treated in details the Upper Cretaceous-Palaeogene palaeophytogeographical regions separable on the basis of geographical distribution of the angiospermal pollen grains. Relying to a larger extent on the spore-pollen data described from the Upper Cretaceous and Palaeogene sediments of the various palaeohpytogeographical regions in North America, we have compliled a stratigraphic table of the major sporomorphic types. Comparing this with that of Europe, interesting results have been obtained. Furthermore, we have dealt with the distribution of types considered to be significant from palaeophytogeographical point of view.

In this paper we endeavour to promote the solution of the problem with regard to the geographical distribution of the major types of the *Aquilapollenites* region on a world-wide scale.

Within the bounds of our limited means we considered all the relevant literature. The distribution of the form-species found in literary data is represented as genera or sub-genera. This work is raising several nomenclature problems. It is not the sole purpose of our work to do a taxonomic revision of the forms discussed for the examination material absolutely indispensable to carry out this task, is not available to us. Nevertheless, we think right, in order to avoid misunderstanding, to enumerate the genera under discussion and to mention the respective taxonomic problems. For the very first one we have the following suggestion.

Fgen.: *Wodehouseia* STANLEY 1961a.
Syn.: 1961 SAMOILOVICH. — *Kryshtofoviana*
1961 SAMOILOVICH. — *Regina*
1961 CHLONOVA. — *Deplexipollis*

1. *W. spinata* STANLEY 1961a
2. *W. fimbriata* STANLEY 1961a
3. *W. calvata* (CHLON. 1961) CHLON. 1962

3/a. *W. calvata* (CHLON. 1961) CHLON. 1962 var. *lindensis* SAMOILOVICH 1965

Note. — Our manuscript had been in press, when the publication of STANLEY 1970 (Bull. of the Georgia Academy of Science 28, 1—44) and that of KRUTZSCH 1970 (Pollen et Spores 12, 103—122) discussing the similar subject were published, thus we could not use their results in our work.

4. *W. oculata* (CHLON. 1961) CHLON. 1962
5. *W. gracile* (SAMOILOVICH 1961) SAMOILOVICH 1966
6. *W. jacutense* (SAMOILOVICH 1961) SAMOILOVICH 1966
7. *W. cirrifer* BRATZEVA 1965
8. *W. stanleyi* SRIVASTAVA 1966
9. *W.* fsp. A (BRATZEVA 1965)
10. *W.* fsp. B (BRATZEVA 1965)

Fgen.: *Azonia* SAMOILOVICH 1961

1. *A. recta* (BOLCHOVITINA 1959) SAMOILOVICH 1961
2. *A. fabacea* SAMOILOVICH 1961

Fgen.: *Jacutiana* SAMOILOVICH 1965

1. *J. hirsuta* SAMOILOVICH 1965

Fgen.: *Orbiculapollis* CHLONOVA 1961

1. *O. globosus* CHLON. 1961
2. *O. faber* CHLON. 1961
3. *O. lucidus* CHLON. 1961
4. Cf. *O.* fsp (SRIVASTAVA 1966)

Fgen.: *Expressipollis* CHLONOVA 1961

1. *E. ocliferus* CHLON. 1961
2. *E. cybaeus* CHLON. 1961
3. *E. accuratus* CHLON. 1961
4. *E. operosus* CHLON. 1961
5. *E. barbatus* CHLON. 1961
6. *E. ambagiosus* CHLON. 1961

As for nomenclature, the greatest problem was raised by genera *Aquilapollenites* ROUSE 1957, *Mancicorpus* MTCHEDLISHVILI 1961, *Integricorpus* MTCHEDLISHVILI 1961, *Projectoporites* MTCHEDLISHVILI 1961, *Tricerapollis* CHLONOVA 1961, *Fibulapollis* CHLONOVA 1961, *Parviprojectus* MTCHEDLISHVILI 1961, *Translucentipollis* CHLONOVA 1961. In studying the available literary data we consider probable that these genera have a morphological connection with one another. Therefore, we suggest to treat the subsequently enumerated genera as sub-genera under genus *Aquilapollenites*.

It is characteristic of the pollen grains of *Aquilapollenites (Aquilapollenites)* that the pole-axis and the „equatorial" axis are equal (Fig. 1). The *Aquilapollenites (Projectoporites)* type may easily be derived by the strong reduction of projections bearing pores. Consequently, the „equatorial" is surpassed by the pole-axis. From this *Aquilapollenites (Parviprojectus)* results whose symmetry is identical with that of the former but the projections bear no germinalia whose functions must have been taken over by certain growths on the poles.

In the same way, we can easily derive morphologically the *Aquilapollenites (Mancicorpus)* type from the *Aquilapollenites (Aquilapollenites)*. Here, the pollen become shorter in the direction of the pole-axis, only at one half. From this we may derive *Aquilapollenites (Fibulapollis)* by which the equato-

rial axis becomes longer and the typical „aquilapollenites germinalia" cannot be recognized. If attention is paid only to the changes in symmetry and the germinalia are left out of consideration then the latter pollen type is nearer to *Aquilapollenites (Aquilapollenites)* — and, in that case, the opposite symmetry-change in the morphological series *Aquilapollenites (Aquilapollenites)* — *Aquilapollenites (Projectoporites)* has taken place.

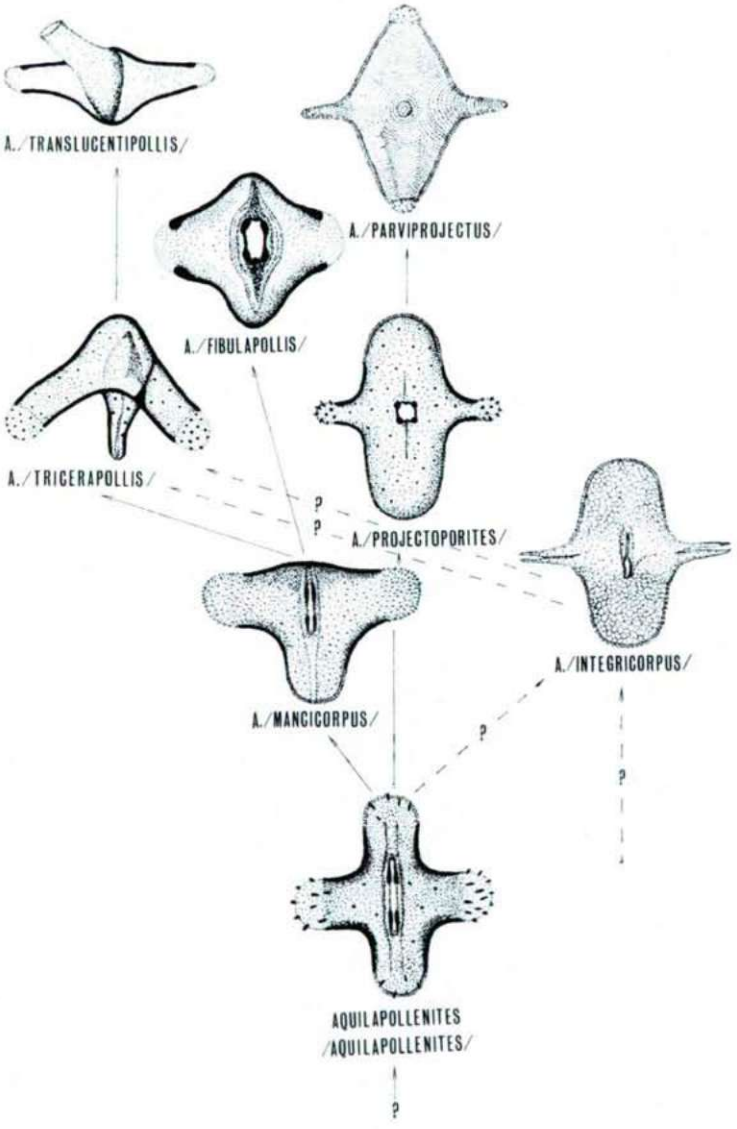

Fig. 1. Morphological series of the various sub-genera of *Aquilapollenites*.

Aquilapollenites (Integricorpus) may be derived, supposedly, from *Aquilapollenites (Aquilapollenites)*. Neither is it excluded, that it is the result of an independent series of development. In regard of its symmetry conditions, it is by and large identical with the *Aquilapollenites (Projectoporites)* type. At any rate, there are instead of the typical „aquilapollenites germinalia".

Aquilapollenites (Tricerapollis) is very interesting from this point of view, for as regards the symmetry conditions, it can be derived from *Aquilapollenites (Mancicorpus)* although the pollen is reduced to projections keeping the germinalia.

It is particularly interesting that of the two germinalia one is „Aquilapollenites" and other is „Integricorpus" in type.

The *Aquilapollenites (Translucentipollis)* type possibly derives from this especially when symmetry conditions are concerned. We must emphasize that the germinalia are similar to those of *Aquilapollenites (Fibulapollis)*.

On the basis of our suggested morphologic series we are led to the conclusion that the modern *Angiospermatophytic* pollen cannot possibly derived from either of the pollen grains mentioned. They must have been, therefore, the pollen grains of the ancient *Angiospermatophyta* that are long extinct.

The following species may be classified into the provisory sub-genera discussed above:

Aquilapollenites Rouse 1957 *(Aquilapollenites)*

1. *A. (A) quadrilobus* Rouse 1957
2. *A. (A) trialatus* Rouse 1957
3. *A. (A) amplus* Stanley 1961c
4. *A. (A) asper* Mtchedlishvili 1961
5. *A. (A) attenuatus* Funkhouser 1961
6. *A. (A) cruciformis* Mtchedlishvili 1961
7. *A. (A) granulatus* Mtchedlishvili 1961
8. *A. (A) insignis* Mtchedlishvili 1961
9. *A. (A) latilobus* Mtchedlishvili 1961
10. *A. (A) quadricretae* Chlonova 1961
11. *A. (A) spinulosus* Funkhouser 1961
12. *A. (A) subtilis* Mtchedlishvili 1961
13. *A. (A) unicus* Chlonova 1961
14. *A. (A) conatus* Norton 1965
15. *A. (A) minimus* Jardiné–Magloire (Belsky, Boltenhagen and Potonié 1965)
16. *A. (A) procerus* Samoilovich 1965
17. *A. (A) rombicus* Samoilovich 1965

Aquilapollenites Rouse 1957 *(Projectoporites* Mtchedlishvili 1961)

1. *A. (P) abscisus* Chlonova 1961
2. *A. (P) magnus* Mtchedlishvili 1961
3. *A. (P) ovalis* Mtchedlishvili 1961
4. *A. (P) spinulosus* Mtchedlischvili 1961
5. *A. (P) amurensis* Bratzeva 1965
6. *A. (P) dolium* Samoilovich 1965
7. *A. (P) reductus* Norton 1965
8. *A. (P) funkhouseri* Srivastava 1966

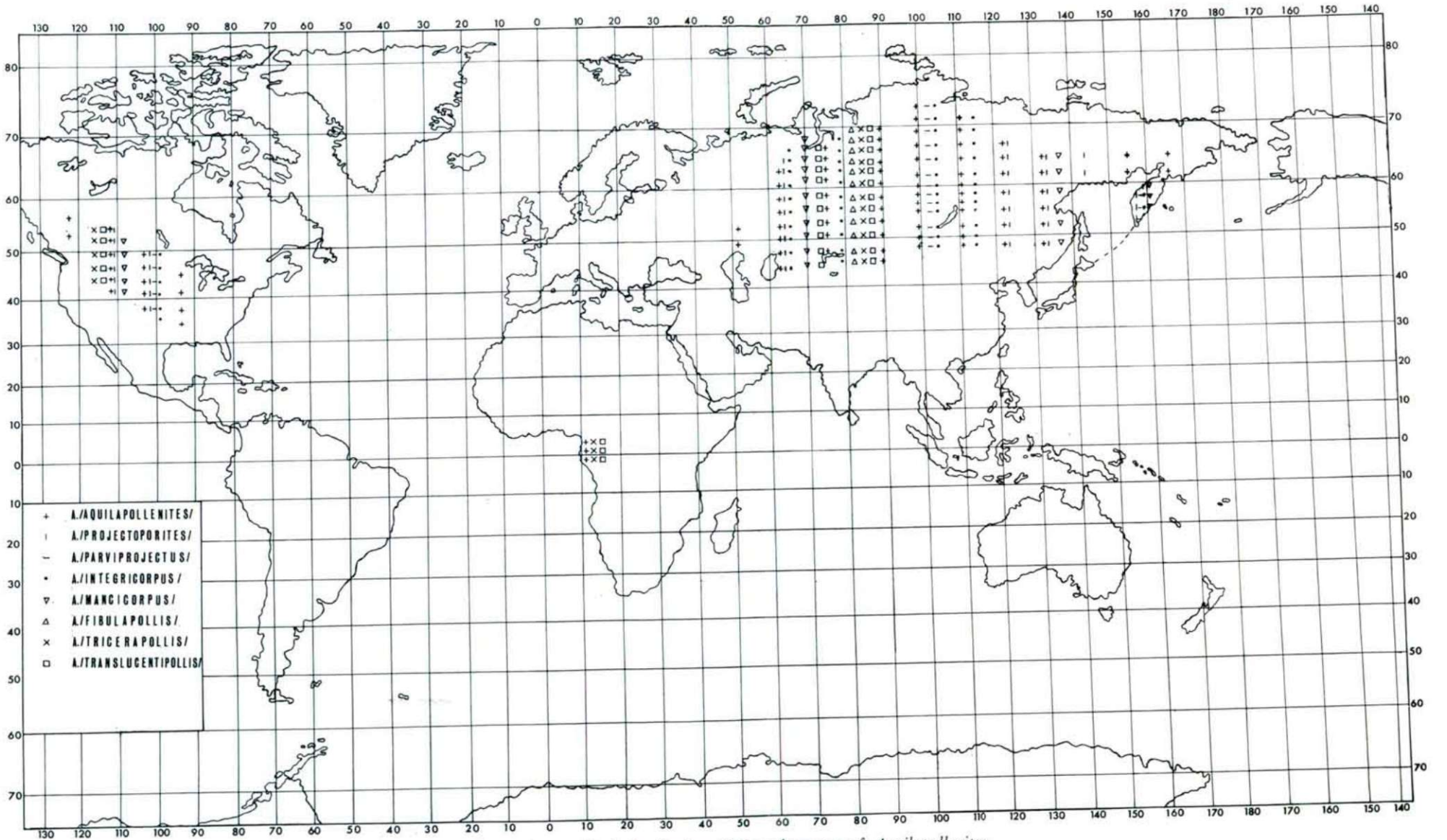

Fig. 2. Geographical distribution of the sub-genera of *Aquilapollenites*.

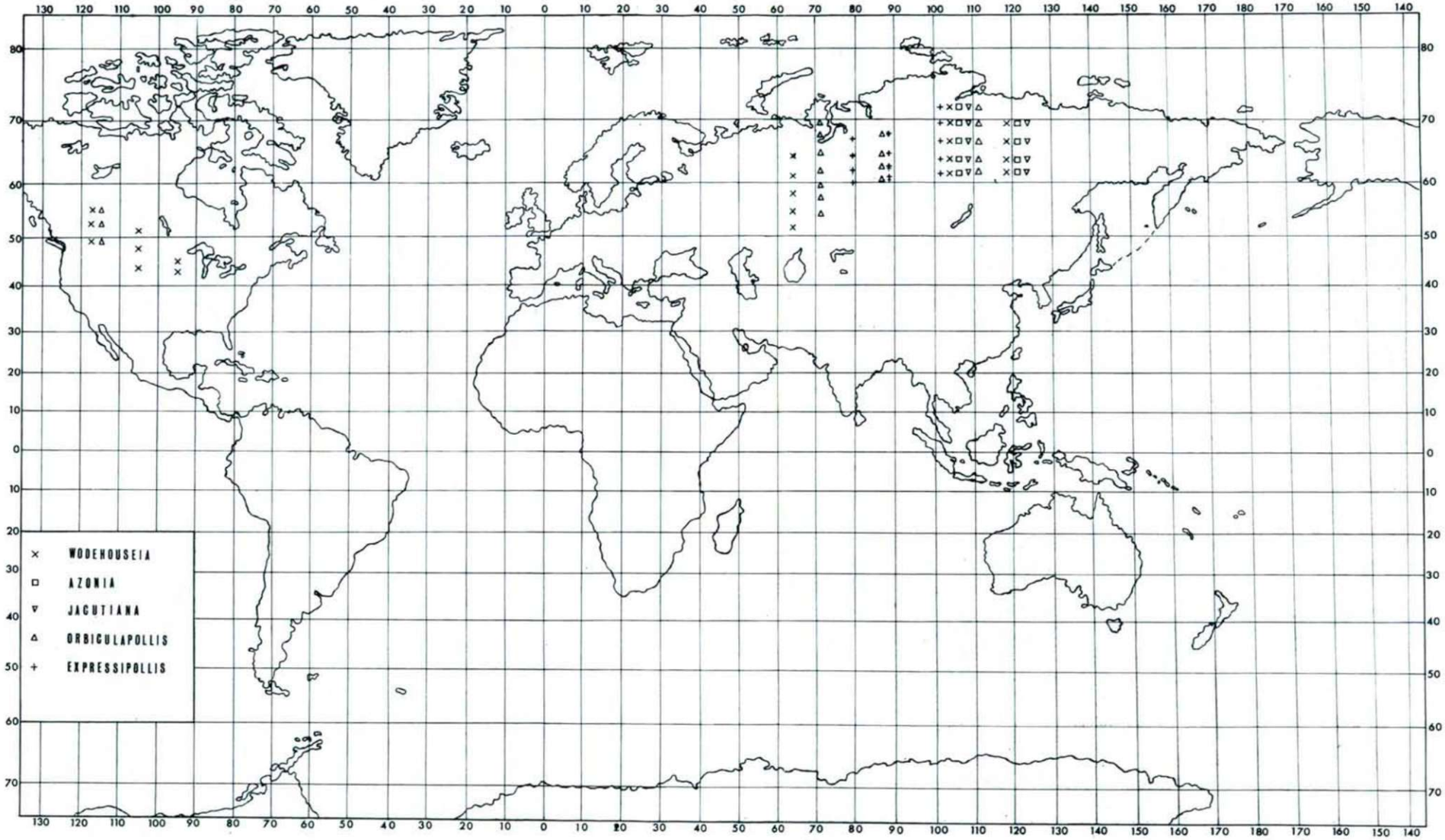

Fig. 3. Geographical distribution of the genera *Wodehouseia*.

sidered as very significant. On the other hand P. M. J. van HOEKEN-KLINKENBERG, according to her kind letter notice, has not found any *Aquilapollenites* in the Upper Cretaceous sediments in Nigeria. Similarly, T. van der HAMMEN reported that this genus is not yet known from the Upper Cretaceous and Lower Palaeogene sediments of South America. Therefore, its presence in equatorial Africa, is a local phenomenon, so far difficult to explain.

The idea my also present itself that there might have been a connection between the Upper Cretaceous florae in Central Siberia and equatorial Western Africa. To answer this question demands further investigations.

The types of the Aquilapollenites genus are particularly frequent in Central Siberia and their distribution is the largest there. It is worth while to consider the distribution of the single sub-genera in Siberia; which is as follows:

Sub-genera	Degree of Latitude	Longitude
A. (Aquilapollenites)	52°—166°	44° —73°
A. (Integricorpus)	66°—159°	44° —73°
A. (Projectoporites)	64°—157°	44° —73°
A. (Parviprojectus)	103°—158°	48° —73°
A. (Translucentipollis)	74°— 87°	44,5°—68°
A. (Mancicorpus)	70°—167°	45° —67,5°
A. (Tricerapollis)	85°	45° —69°
A. (Fibulapollis)	83°	45° —67,5°

These forms mass particularly in Central Siberia, in the territory between latitude 70—90 and longitude 44—70. As the number of the types is decrasing in eastern and south-western directions, the conclusion must be drawn that this territory one of the main centres of evolution of ancient *Angiosperms* in the Upper Cretaceous in the northern hemisphere.

The other one, the centre of *Normapolles,* might have been in Middle and Western Europe.

According to this concent the *Aquilapollenites* producting plants in North America have been derived from the Siberian centre by radiation. This is supported by the evidence that in North America there is no recent type in this group and that this genus is known there primarily from the Upper Cretaceous, Maestrichtian and the Lower Palaeocene sediments. On the other hand, mainly in Central Siberia, it was found in the lower levels of the Upper Cretaceous, as well.

The distribution of sub-genera *Aquilapollenites* in North America is as follows:

Sub-genera	Degree of Latitude	Longitude
A. (Aquilapollenites)	93°—123°	34°—57°
A. (Projectoporites)	102°—110°	42°—54°
A. (Tricerapollis)	117°	43°—54°
A. (Translucentipollis)	115°	43°—54°
A. (Mancicorpus)	108°	42°—52°
A. (Parviprojectus)	101°	38°—49°
A. (Integricorpus)	99°	36°—49°

It must further be noted in connection with the distribution in Siberia that toward east from latitude 90° their southern boundary is somewhat strifted towards north.

In North America and in Siberia the northernmost and southernmost presence of the genus, as known so far, is as follows:

	In North America	In Siberia
a) Northernmost boundary	57°	73°
b) Southernmost boundary	34°	44°

In the two continents a difference of 16° between the northern and 10° between the southern boundaries can be observed.

It should be emphasize that these differences may modify when further localities were found. We think, anyway that these results support the earlier suppositions concerning the shifting of poles.

In connection with the other examined genera — *Wodehouseia, Azonia, Jacutiana, Orbiculapollis,* and *Expressipollis* — further conclusions my be drawn:

For the time being, these genera are unknown from the southern hemisphere.

Their centre might have been in Siberia, more to the north-east than that of *Aquilapollenites,* most likely in the territory between latitude 100—125° and longitude 60—72°.

At latitude 64°, the difference between the southern boundaries of *Aquilapollenites* and *Wodehouseia* is 8° in Siberia, and at about at latitude 100° it is 14°. In this way, in Siberia, advancing in eastern direction, and compared to *Aquilapollenites,* the southern boundary of *Wodehouseia* and that of the genera examined in Fig. 3 is more and more shifted towards north while the northern boundaries are approximately the same. The displacement of distribution towards north took place with the genera mentioned above between latitude 70—80°, and in the case of *Aquilapollenites* between latitude 90—100°.

It is interesting and difficult to find an explanation why in the easternmost territory of the Soviet Union *Wodehouseia* and other genera described with it are not known, while in North America *Wodehouseia* could be found in several localities, and there are some data about genus *Orbiculapollis,* too.

The distribution of *Jacutiana* is local, for the time being.

In North America and Siberia, comparing first of all the northernmost and southernmost boundaries of *Wodehouseia,* we can establish that it is distributed more southerly in North America than in Siberia, its southern boundary reaches almost the southern boundary of the distribution of *Aquilapollenites* in Siberia.

Aquilapollenites is distributed in North America 9°, in Siberia 8° more to the south than the *Wodehouseia.*

The data concerning the above are summarized in the following tables:

Siberian distributions

Genera	Degree of Latitude	Degree of Longitude
Wodehouseia	64°—119°	52°—72°
Orbiculapollis	72°—112°	54°—72°
Expressipollis	79°—102°	60°—72°
Azonia	116°—121°	62°—72°
Jacutiana	118°—124°	62°—72°

North America distributions

Genera	Degree of Latitude	Degree of Longitude
Wodehouseia	94°—118°	43°—56°
Orbiculapollis	114°	49°—56°

In summing up, we can establish the following:

1. On the northern hemisphere we can distinguish two main centres of evolution for ancient *Angiosperms*. Partly the Middle and Western European *Normapolles* centre, partly the Central Siberian *Aquilapollenites* centre.

2. There are considerable differences between the southern boundaries of the Siberian and North American distributions of genus *Aquilapollenites*.

3. In Siberia, advancing eastwards, the distribution of genus *Aquilapollenites* is somewhat shifted toward the north.

4. Both in North America and Siberia, the southern boundary of genus *Wodehouseia* is more northerly than that of *Aquilapollenites*.

5. In Siberia, the northerly shifting of the southern boundary of genus *Aquilapollenites*.

References

ALEXANDROVA, L. V., BOEVA, O. A., GRIGOREVA, K. N., KRASNOVA, L. IA., ILENOK, L. L. MARKOVA, L. G., POPOVA, V. M., SKURATENKO, A. V., SIRKOVA, Y. F.—EBIGER, I. S. (1962): Spores et pollens des sédiments jurasiques, crétacés, et tertiaires de la région du Siberie occidentale (en russe). — Tr. Inst. Geol. Geophys., Sibirsk. Otd. Akad. Nauk. S. S. S. R. *22*, 419—506.

BELSKY, C. Y., BOLTENHAGEN, E.—POTONIÉ, R. (1965): Sporae dispersae der Oberen Kreide von Gabun, Aquatoriales Afrika. — Paläont. Z. *39*, 72—83.

BOLCHOVITINA, N. A. (1959): Spore and pollen assemblages from Mesozoic sediments of the Vilyui Depression and their stratigraphic significance. — Tr. Inst. Geol. Nauk. Akad. Nauk. S. S. S. R., Geol. ser. *24*, 1—185. (Russian).

BONDARENKO, N. M. (1957): Palynological characteristic of the Upper Cretaceous sediments of the Ust-Yenisey Depression. — Nauchn. Issled. Inst. Geol. Arktiki, Sb. Tr. po Paleontol. Biostratigr. 2, 45—75. (Russian).

BONDARENKO, N. M. (1958): Palynological characteristic of the Albian and Upper Cretaceous sediments of the Khatanga Depression. — Nauchn. Issled. Inst. Geol. Arktiki, Sb. Tr. po Paleontol. Biostratigr. *7*, 43—54 (Russian).

BONDARENKO, N. M. (1965): Palynological evidence for the stratigraphy of the Upper Cretaceous sediments in the Bolshaya Laide river basin (Ust-Yenisey region). — Tr. Nauchn. Issled. Inst. Geol. Arktiki, Paleontol. Biostratigr. *8*, 75—86 (Russian).

BONDARENKO, N. M. (1966): New species of Late Cretaceous plants of northern Siberia determined from spores and pollen grains. — Uchen. Zap. Nauchn. Issled. Inst. Geol. Arktiki, Paleontol. Biostratigr. *14*, 75—88 (Russian).

BRATZEVA, G. M. (1965): Pollen and spores in Maestrichtian deposits of the Far East. — Acad. of Sci. of the USSR, Geol. Inst. Tr. *129*, 1—42.

BRATZEVA, G. M. (1966): The age of „Tsagainsk flora" in Asia (on the basis of spore and pollen analysis data). — The importance of palynological analysis for the stratigraphic and paleofloristic investigations, Nauca 136—141 (Russian with English summary).

BRATZEVA, G. M. (1967): The problem of the Tsagainsk flora with regard to spore-and-pollen analytical data. — Rev. Palaeobotan. Palynol. *2*, 119—126.

CHLONOVA, A. F. (1957): Distingnishing of Index Species in Age Determination of Deposits according to Spore-Pollen Analysis. — Isv. Vost. Fil. AN S. S. S. R. 2, (Russian).

CHLONOVA, A. F. (1960): Specific composition of the Pollen and Spores in the Upper Cretaceous sediments of the Chulymo-Yenisey depression. — Tr. Inst. Geol. Geophys., Sibirsk. Otd. Acad. Nauk. S. S. S. R. *3*, 1—104 (Russian).

CHLONOVA, A. F. (1961): Spores and Pollen of the upper half of the Cretaceous sediments in the eastern part of the West-Siberian Depression. — Tr. Inst. Geol. Geophys. Sibirsk. Otd. Acad. Nauk. S. S. S. R. *7*, 1—138 (Russian).

CHLONOVA, A. F. (1962a): Some morphological types of spores and pollen grains from Upper Cretaceous of eastern part of West Siberian Lowland. — Pollen et Spores *4*, 295—309.

CHLONOVA, A. F. (1962b): Index species of spores and pollen in Upper Cretaceous deposits of the eastern part of the West-Siberian Lowland. — Pollen et Spores *4*, 357.

FUNKHOUSER, J. W. (1961): Pollen of the genus *Aquilapollenites*. — Micropaleontology *7*, 193—198.

HALL, J. W.—NORTON, N. J. (1967): Palynological evidence of floristic change across the Cretaceous-Tertiary boundary in Eastern Montana (U. S. A.). — Palaeogeogr. Palaeoclimatol. & Palaeoecol. *3*, 121—131.

JONES, E. L. (1962): Palynology of the Midway-Wilcox boundary in South-Central Arkansas. — Transactions of the Gulf Coast Association of Geological Societies *12*, 285—294.

KEDVES, M.—KIRÁLY, EMŐKE (1968): A propos des régions paléogéographiques du Crétacé et du Paléogène, d'après les données palynologiques. — Acta Biol. Szeged *14*, 19—28.

LEFFINGWELL, H. A. (1962): Uppermost Cretaceous and Lower Paleocene spore-pollen assemblages in the type area of the Lance formation Wyoming. — Pollen et Spores *4*, 360.

MALIAVKINA, V. S.—SAMOILOVICH, S. R. (1961): Incertae sedis. — Trud. 177 V. N. I. G. R. I., 251—259. (Russian).

MTCHEDLISHVILI, N. D. (1961a): Triprojectacites. — Trud. 177 V. N. I. G. R. I., 203—229. (Russian).

MTCHEDLISHVILI, N. D. (1961b): Angiospermae (*Triproletes, Triporina*, etc.). — Trud. 177 V. N. I. G. R. I., 244—251. (Russian).

MTCHEDLISHVILI, N. D.—SAMOILOVICH, S. R. (1962a): Common elements in the Mesozoic and Cenozoic floras of Western Siberia and Australia. — For the First International Conference on Palynology (Tucson, USA), Reports of Soviet Palynologists 94—104.

MTCHEDLISHVILI, N. D.—SAMOILOVICH, S. R. (1962b): Common elements in the Mesozoic and Cenozoic floras of Western Siberia and Australia. — Pollen et Spores *4*, 365.

MTCHEDLISHVILI, N. D. (1965): The significance of angiospermous plants for the stratigraphy of the Upper Cretaceous sediments. — Tr. Vses Nauchn. Issled. Geologorazved. Inst. *239*, 5—34. (Russian).

NORTON, N. J.—HALL, J. W. (1962): Pollen and spores from the Colgate member of the Fox Hills Sandstone at its type locality. — Pollen et Spores *4*, 367—368.

NORTON, N. J. (1965a): Palynology of the Upper Cretaceous and Lower Tertiary in the type locality of the Hell Creek Formation. — Amer. J. Bot. *52*, 639.

NORTON, N. J. (1965b): Three new species of *Aquilapollenites* from the Hell Creek Formation, Garfield Country, Montana. — Pollen et Spores *7*, 135—143.

NORTON, N. J.—HALL, J. W. (1967): Guide sporomorphae in the Upper Cretaceous-Lower Tertiary of Eastern Montana (U. S. A.). — Rev. Palaeobotan. Palynol. *2*, 99—110.

POLUMISKOVA, K. A., TEREKHOVA, E. K., BLIAKHOVA, S. M.—PONOMARENKO, Z. K. (1966): Change in floras during the Upper Cretaceous and Paleogene time on the territory of Kazakhstan. (In Russian, with English summary). — The importance of palynological analysis for the stratigraphic and paleofloristic investigations, Nauca, 154—158.

PONOMARENKO, Z. K. (1966): The age and paleogeographical environments of bauxite formations in Kazakhstan. (In Russian, with English summary). — The importance of palynological analysis for the stratigraphic and paleofloristic investigations. Nauca 148—154.

ROUSE, G. (1957): The Applications of a New Nomenclatural Approach to Upper Cretaceous Plant Microfossils from Western Canada. — Can. J. Bot. *35*, 349—375.

SAMOILOVICH, S. R. (1961a): *Kryshtofoviacites.* — Trud. 177 V. N. I. G. R. I., 230—244. (Russian).

SAMOILOVICH, S. R. (1961b): Palynological characteristics of the Cretaceous sediments of the West-Siberian depression (Coniacian-Santonian-Campanian and Maastrichtian). In:Pollen and Spores of Western Siberia. — Tr. Vses. Nauchn. Issled. Geologorazved. Inst. *177*, 304—329. (Russian).

SAMOILOVICH, S. R. (1965a): On the age of the Lyndenskaya Suite. — Tr. Vses. Nauchn. Issled. Geologorazved. Inst. 239, 79—86. (Russian).

SAMOILOVICH, S. R. (1965b): Especes de pollen nouvelles du Crétacé supérieur de Yacutie. — Tr. Vses. Nauchn. Issled. Geologorazved. Inst. *239*, 121—141 (en russe).

SAMOILOVICH, S. R. (1967): Tentative botanico-geographical subdivision of northern Asia in late Cretaceous time. — Rev. Palaeobotan. Palynol. *2*, 127—139.

SRIVASTAVA, S. K. (1966): Upper Cretaceous microflora (Maestrichtian) from Scollard, Alberta, Canada. — Pollen et Spores *8*, 497—552.

SRIVASTAVA, S. K. (1967): Palynology of Late Cretaceous Mammal Beds, Scollard, Alberta Canada. — Palaeogeography. Palaeoclimatol., Palaeoecol. *3*, 133—150.

STANLEY, E. A. (1961a): A new sporomorph genus from northwestern south Dakota. — Pollen et Spores *3*, 155—162.

STANLEY, E. A. (1961b): Upper Cretaceous and Lower Tertiary sporomorphae from northwestern south Dakota. — Diss. Abstr. 21/7, 1. C. Card No Mic 60—5461.

STANLEY, E. A. (1961c): The fossil pollen genus *Aquilapollenites.* — Pollen et Spores *3*, 329—352.

STANLEY, E. A. (1965a): Upper Cretaceous und Paleocene plant microfossils and Paleocene Dinoflagellates and Hystrichosphaerids from Northwestern South Dakota. — Bull. of American Paleontology *49*, 179—384.

STANLEY, E. A. (1965b): Use of reworked pollen and spores for determining the Pleistocene — recent and the intra Pleistocene boundaries. — Nature *206*, 289—291.

VAKULENKO, A. S. (1961): Aspect sporo-pollinique des sédiments tertiaires du sondage No 1 de la région de Novo Port. — Tr. Nauchn. Issled. Inst. Geol. Arktiki *124*, 137—161. (en russe).

ZAKLINSKAIA, E. D. (1962): Importance of *Angiosperm* pollen for the stratigraphy of Upper Cretaceous and Lower Paleogene deposits and botanico-geographical provinces at the boundary between the Cretaceous and Tertiary systems. — For the First International Conference on Palynology (Tucson, USA), Reports of Soviet Palynologists 105—113.

ZAKLINSKAIA, E. D. (1963): Le pollen des *Angiospermes* et sa significance pour la recherche de la stratigraphie du Crétacé supérieur et du Paléogene — Moscou. (en russe).

ZAKLINSKAIA, E. D. (1966): Pollen morphology of Angiosperms and palaeofloristic areas and provinces at the boundary of the Cretaceous and Paleogene. — The Palaeobotanist *15*, 110—116.

ZAKLINSKAIA, E. D. (1967): Palynological studies on late Cretaceous-Paleogene floral history and stratigraphy. — Rev. Palaeobotan. Palynol. *2*, 141—146.

Address of the authors:
Dr. M. KEDVES,
EMŐKE KIRÁLY
Department of Botany, A. J. University,
Szeged, Hungary