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Early angiosperms of Siberia

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In Siberia region remains of angiosperms firstly appeared in the middle Albian, in deposits of the Buorkemuss Formation of Kolyma River Basin and in deposits of the Khatyryk Formation of Leno-Viluj Basin. The floras of this age are characterized by the highest taxonomic diversity during the Cretaceous (100-140 species). Such high diversity and penetration of thermophilic elements, primarily cycadophytes, from the south suggest a warm and humid climate at that time. The Czekanowskiales, a temperate group of the Mesozoic gymnosperms, are diverse, but not abundant. The dominant plant communities are perceived as closed mostly deciduous forests consisted of conifers, ginkgophytes and czeakanowskialeans. As far as is suggested by taphonomic characters of their localities, these plants might have formed mono-dominant communities. Another widespread vegetational type was represented by open herbaceous to shrubby communities consisted of ferns and cycadophytes. The fern diversity during the Early Cretaceous was negatively correlated with the diversity of ginkgophytes, czeakanowskiales and conifers. Such relationships can be evidence that the majority of ferns formed separate communities rather than were incorporated as undergrowth in the ginkgo-conifer forests.

The optimal climatic conditions promoted high speciation in both the older Mesozoic and younger groups. Among the older taxa, the highest diversity was achieved by the Ginkgoales, conifers *Podozamites*, ferns *Cladophlebis* and *Coniopteris*. At the same time, there was a considerable increase of taxonomic diversity in new fern groups that became common in the mid-Cretaceous time: the Osmundaceae, Aspleniaceae, *Arctopteris*, *Birisia*, *Acrostichopteris*, as well as the geologically younger groups of conifers, such as the Taxodiaceae, Taxaceae, Cupressaceae and Pinaceae that formed the bulk of the Late Cretaceous conifer diversity.

The early angiosperms had very small leaves of xeromorphic aspect. They may have grown as a minor component in the open shrubby communities as well as in herbaceous wetland vegetation in association with cycadophytes, some conifers and ferns.

The angiosperms might spread to Siberia from the southern regions where they had appeared somewhat earlier. There are few or no common species and few common genera in angiosperms from different localities, so that by this time they already had attained a high taxonomic diversity that rapidly increased.

The middle Albian floras of Siberia show that the early spreading of angiosperms was not accompanied by reduction of the older Mesozoic groups that had also experienced a progressive phase in their evolution at that time. The extinction or considerable reduction of major Mesozoic groups of ferns, cycadophytes and ginkgoaleans took place in the late Albian, and are connected with climate cooling. The survivors among the ferns and conifers were primarily the widespread eurytopic species that later formed a characteristic transitional group in a number of mid-Cretaceous fossil floras.

The process of replacement of the older Mesozoic elements went on in the Cenomanian. In this time the conifers *Parataxodium*, *Araucarites*, *Sequoia* and *Elatocladus* became dominant. The Cenomanian angiosperms represent an entirely new stage of evolution in this group. The small-leaved shrubby forms, members of the Mesozoic-type communities, were replaced by broad-leaved arboreal plants that could probably form predominantly angiosperm communities. In the Cenomanian, diverse platanoids and representatives of genus *Trochodendroides* first appeared. Later these taxa formed a core of the Late Cretaceous floras in Siberia.

