

## ECOLOGICAL DOMINANCE OF CRETACEOUS ANGIOSPERMS: WHEN AND AT WHOSE EXPENSE, ACCORDING TO THE POLLEN RECORD

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Angiosperms dominate modern terrestrial vegetation. However, dominance may be used to imply greatest diversity globally or locally, or may refer to ecological abundance, e.g., most abundant taxon within a community. The timing and conditions of the angiosperm rise to dominance are important for both ecological and evolutionary investigations. Previous paleobotanical studies have demonstrated that by the end of the Cretaceous, angiosperms constituted more than 50% of total plant diversity and approximately 50-70% of the within-flora diversity. Wing et al. (1993), sampling *in situ* Campanian-Maastrichtian macrofloras preserved by volcanic ash, have documented similar local within-flora diversity of angiosperms, but relatively little contribution by angiosperms to ecological abundance. Only at disturbed sites did angiosperms dominate vegetational cover. Is this pattern unusual or the ecological norm for the Late Cretaceous?

I analyzed over 250 palynological samples reported in the literature from throughout North America to obtain a complementary measure of angiosperm abundance. The samples span the Aptian through Maastrichtian and are complete with respect to recovered terrestrial plant species (no groups explicitly omitted). Lithological data was recorded where available. Species were grouped as angiosperm, gymnosperm, or free-sporing, and the within-sample percent abundance of each group calculated. Results indicate that angiosperms were not generally the dominant group (here and below meaning >50% of specimens) within a sample until the Maastrichtian. Free-sporing plants (bryophytes and pteridophytes) and gymnosperms were the dominant groups in the Early Cretaceous. Few Late Cretaceous (pre-Maastrichtian) palynomorph samples have a dominant group; when found, the dominant group varies. The observed patterns are not affected by restricting the analysis only to those samples inferred to be terrestrial in origin. Results show that there was no apparent difference in the timing of the angiosperm rise to dominance between peat swamp (coal/lignite) and clastic environments. It is not yet possible to determine the effect of latitude on timing, but in the Maastrichtian, sites grouped by paleolatitude (<40°N and >40°N) both show angiosperm dominance.

As angiosperms rose in abundance through the Cretaceous, gymnosperms and free-sporing plants declined. Although partly an artifact of percentages, gymnosperms exhibited the greatest decline in mean abundance, while free-sporing plants showed only a modest decline in mean abundance. This contrasts with the pattern found by Lidgard and Crane (1990) for floristic diversity (percent of species in flora assigned to each group) in which free-sporing plants exhibited the greatest decline in floristic diversity and gymnosperms showed only a slight decline as angiosperms rose. This pattern may be the result of the general decline in the abundance of cheirolepidiaceus conifer pollen (*Classopollis*), which is not reflected in taxonomically-significant morphological diversity.