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The early evolution of angiosperms – a stratigraphic perspective

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The late Early Cretaceous radiation of flowering plants (angiosperms) represents one of the most fundamental changes in the history of terrestrial ecosystems. Despite the significance of this major floral turnover, the temporal and spatial patterns of the early angiosperm evolution and diversification are not very well constrained. Stratigraphically controlled pollen data from Portuguese coastal deposits (Late Barremian to Middle Albian) provide a well-dated record of the early radiation of angiosperms from a low-to mid-latitude site. The corresponding near-shore successions are dated with a combined biostratigraphic and chemostratigraphic approach including dinoflagellate marker species, C-isotopes of bulk carbonate and Sr-isotopes derived from unaltered oyster shell calcite. Based on the stratigraphic results an integrated time-framework has been established, which allows for a detailed comparison of the Portuguese pollen data with the classical pollen record from the continental Potomac Group (USA). The correlation between the different localities reveals that the lower part of the Potomac Group succession contains several significant discontinuities, which correspond to the lithostratigraphic boundaries between the Patuxent, the Arundel Clay and the Patapsco Formations. In addition, our results from Portugal document an early radiation phase of monocolpate angiosperm pollen of monocot and/or magnoliid affinity, which covers the Early Aptian to Early Albian interval preceding the radiation of eudicots by at least 10 Ma. Temporal correlation of the angiosperm pollen records with global palaeoenvironmental changes point towards a possible link between the rapid adaptive radiation of flowering plants and major climatic and oceanographic perturbations during the late Early Cretaceous.