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Early to mid Cretaceous vegetation of northern Gondwana - the onset of angiosperm radiation and climatic implications

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Early Cretaceous Northern Gondwana seems to be the cradle of many early flowering plants, especially mesangiosperms that include magnoliids and monocots and basal eudicots. So far our knowledge was based mostly on dispersed pollen and small flowering structures. New fossil finds from Brazil include more complete plants with attached roots, leaves and flowers. Taxonomic studies show that these fossils belonged to clades which are, based on macroscopic characters and molecular data, also considered to be rather basal, such as several members of Nymphaeales, Piperales, Laurales, Magnoliales, monocots (Araliaceae) and Ranunculales.
Various parameters can be used in order to understand the physiology and habitat of these plants. Adaptations to climate and habitat are partly mirrored in their root anatomy (evidence of tap roots), leaf size and shape, leaf anatomy including presence of glands, and distribution of stomata. An important ecophysiolocical parameter is vein density as an indicator for the plants' cabability to pump water, and the stomatal pore index, representing the proportion of stomatal pore area on the leaf surface, which is related to the water vapor resistance of the leaf epidermis. During the mid-Cretaceous leaf vein density started to surpass that of gymnosperms, one factor that made angiosperms very successful in conquering many kinds of new environments. Using data on these parameters we deduce that during the late Early to mid Cretaceous angiosperms were already diverse, being represented as both herbs, with aquatic members, such as Nymphaeles, helophytes (e.g. some monocots) and plants that may have grown in shady locations. Other life forms included shrubs and perhaps already small trees (e.g. Magnoliales). These flowering plants occupied various habitats, ranging from xeric (e.g. some Magnoliales) to mesic and shady (e.g. Piperales) or aquatic (e.g. Araceae, Nymphaeales). Overall, it seems that several of these plants clearly exhibited some mechanisms to withstand drought, which in turn let us assume that the climate was characterized by dry and wet seasons.