



Latest Cretaceous, Paleocene and Eocene floras from Patagonia: a critical piece of Gondwana's floral history comes into focus

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Patagonia contains a rich and fairly continuous paleobotanical record from the late Maastrichtian to the middle Eocene, an interval known globally for mass extinction and significant climate changes. From this time interval, we have quantitatively collected and stratigraphically studied over 600 species and 20000 specimens from eight well-preserved compression macrofloras from north-west and central Patagonia. Cretaceous and early Paleocene floras are from coastal environments, whereas the Eocene floras are from volcanoclastic lake sediments. Several sites and stratigraphic levels in the early Paleocene Salamanca Formation show higher richness than comparable Northern Hemisphere floras, but they are relatively impoverished when compared to those of the upper Maastrichtian Lefipan Formation. Probable middle Paleocene floras from the Peñas Coloradas Formation share most species with the Salamanca Formation, but are preserved in fluvial facies. Bedded tuffs at the Eocene sites have yielded precise ^{40}Ar - ^{39}Ar dates of 54.24 ± 0.45 Ma for the Pampa de Jones flora, 51.91 ± 0.22 Ma for the extremely diverse Laguna del Hunco flora, and 47.46 ± 0.05 Ma for the similarly rich Río Pichileufú flora. The history of Patagonian plant diversity in the early Paleogene could be linked to a relatively lower effect of the terminal Cretaceous event and high diversification and immigration during Eocene warming. Although the biogeographic signature of the floras is clearly Gondwanic, during the Paleocene there appears to be greater compositional distinctiveness from coeval Australasian floras than in the Eocene, suggesting some degree of endemism after the K-T. The Eocene floras include beautifully preserved examples of extant Australasian tree genera that are now extinct in South America, including *Agathis*, *Papuacedrus*, *Dacrycarpus*, *Eucalyptus*, *Cassuarinaeaceae*, and *Akaniaceae*. Paleoclimate analyses based on the macrofloras indicate subtropical and moist growing conditions; during the Eocene there is evidence for true rainforest conditions. These results contribute a considerably improved framework to understanding the plant evolution in Gondwana.

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