

Mammalian faunal change across the Paleocene-Eocene boundary in NW Europe: the roles of displacement, community evolution and ecology

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The succession of mammal faunas across the Paleocene-Eocene (P-E) transition in Europe is best represented in the north west of the continent in the Anglo-Franco-Belgian Basin area. Here the P-E boundary is marked by a major turnover, the Mammalian Dispersal Event, and a change in the pattern of ecological diversity. Recently described taxa from the earliest Eocene and new taxa under study from the latest Paleocene show that the turnover was more major than previously recorded. Of 45 species in the latest Paleocene Paris Basin sites of Cernay, Berru and Montchenot, only five survived unchanged, whilst a further five appear to have given rise to slightly modified species. An eleventh species belongs to a clade that reappeared late in the PETM. Extinction at the end of the Paleocene therefore totals 76%. Most of the species and clades surviving the P-E boundary in NW Europe scarcely survived the PETM, with the notable exception of the plesiadapiform families Toliapinidae and Plesiadapidae, the latter surviving till the end of the Early Eocene. 76% of the 42 species occurring in the first mammal zone (PE I) of the Eocene have no close relatives in the Paleocene of NW Europe and are judged to have dispersed there, the majority from North America.

Recently improved knowledge of the postcranial skeleton of various extinct groups of small mammals (multituberculates, nyctitheriids, adapisoriculids and louisinines) allows more accurate recording of their locomotor adaptations in ecological diversity studies (Kielan-Jaworowska & Gambaryan 1994; Hooker 2001; Smith *et al.* 2009; Zack *et al.* 2005). Early Eocene faunas are similar to those of modern tropical forests in terms of their proportions and ranges of size, locomotor adaptation and diet. In contrast, latest Paleocene faunas differ somewhat from this habitat type in their size and locomotion categories. They differ in that there are no mammals larger than 45 kg, the terrestrial percentage is high and there are no arboreal types. Also most of the fruit consumers in the latest Paleocene were terrestrial or semiterrestrial, whereas in the Early Eocene far more were tree-dwelling. The restricted size might suggest denser forest in the latest Paleocene, whilst the importance of ground-dwelling frugivores at that time might suggest less diverse or less abundant tree fruits than in the Early Eocene. Currently, this habitat change hypothesis cannot be tested independently since contemporaneous fossil floras are either small or in need of revision. The absence of arboreal and aerial mammals in these Paleocene faunas is indicative of a widespread constraint in mammalian community evolution at this time, Early Eocene faunas showing distinct modernisation in respect of these locomotor strategies. Competitive exclusion and predation by the incoming fauna at the P-E boundary is strongly indicated by the large scale and high rate of the turnover. The large scale of the displacement and community evolution factors may be obscuring patterns of ecological change.

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