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The role of the North Atlantic Land Bridge for Neogene transatlantic plant migration: Morphological, molecular and fossil evidence

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Biogeographic reconstructions usually rely on molecular phylogenies and the modern distribution of taxa. This approach suffers from two major limitations: Molecular phylogenies do not include any information about extinct lineages or ancestral taxa. Moreover, the modern distribution of a (monophyletic) group of taxa is not necessarily congruent with its ancient distribution. Geological evidence is controversial about the timing of termination of the North Atlantic Land Bridge. Molecular, morphological and fossil data from three genera (*Fagus, Quercus,* and *Platanus*) indicate functionality of the North Atlantic Land Bridge until the latest Miocene. (1) In the Miocene, *Fagus* colonized Iceland twice: One lineage of Pacific North American origin colonized northern North America in the course of the Eocene and later migrated to Iceland (*F. friedrichii*). The modern North American *F. grandifolia* may be the remnant of this wide-spread high-latitude lineage. Later in the Miocene, a second type is found both in Iceland and Europe (*F. gussonii*). The systematic affinities of *F. gussonii* are unclear; one possible explanation would be contact between (continental) Eurasian and North American-Icelandic lineages. (2) In the case of *Quercus,* palynological data suggest two colonization events. First, wide-spread members of the infrageneric group *Quercus* (the white oaks) arrived in Iceland at 9-8 Ma, possessing a pollen type found in North American as well as Eurasian modern and fossil taxa. Modern white oaks are genetically weakly differentiated; similar to identical genetic types are found in Europe, East Asia and North America. Evidence for a second migration to Iceland in the latest Miocene (ca 5.5 Ma) comes from pollen found only in modern North American members of the infrageneric groups *Quercus* and *Lobatae* (white and red oaks). (3) Differentiation and biogeographic patterns in *Platanus* are far more complex. Data from three nuclear DNA markers of modern species of *Platanus* indicate phases of widespread and complex ancient reticulation. Particularly, the modern European *P. orientalis*, although more closely related to the western North American *P. racemosa* and allies, is genetically also linked to taxa from northern Mexico and the eastern United States forming the *P. occidentalis* species aggregate. Tertiary European fossils resemble *P. occidentalis* but not *P. orientalis.* In Iceland, *Platanus* is found in 15 to 12 Ma sediments: A functionality of the NALB in the Middle Miocene could explain the unexpected genetic links between *P. occidentalis* and *P. orientalis*, and other Northern Hemispheric genera.