



## Migrations of European honey bee lineages into Africa, Asia, and North America during the Oligocene and Miocene

Ulrich Kotthoff (1), Torsten Wappler (2), and Michael Engel (3)

(1) Department of Geosciences, Hamburg University, Hamburg, Germany (ulrich.kotthoff@uni-hamburg.de), (2) Steinmann-Institute for Geology, Mineralogy, and Palaeontology, Bonn University, Bonn, Germany, (3) Division of Entomology, Natural History Museum, and Department of Ecology & Evolutionary Biology, University of Kansas, Lawrence, USA

Today honey bees, principally the western honey bee, *Apis mellifera*, represent a multi-billion dollar agricultural industry. Through the efforts of humans they have become established well outside of their modern native ranges, having been introduced multiple times into the Americas, Australia, New Zealand, New Caledonia, and many areas of Oceania.

The native, i.e., non-human influenced, distribution and migration of honey bee species and populations has been a matter of serious and continued debate. Apicultural dogma informs us that the center of origin of honey bees (genus *Apis*) resides in Asia, with subsequent migration and diversification into Europe and Asia. Recent population genetic studies of the western honey bee, *Apis mellifera*, slightly modified this received wisdom by suggesting that this species originated in Africa and subsequently reinvaded Eurasia. Research into the historical biogeography of honey bees has ignored entirely the abundant fossil evidence distributed through a variety of Late Paleogene (Oligocene) and Early Neogene (Miocene) deposits, a diversity which is predominantly European in origin, particularly among the most basal species of the genus.

We have examined the morphological disparity and affinities of the full living and fossil diversity of honey bees ranging from their earliest origins to the present day. This analysis indicates that honey bees exhibited a greater morphological disparity during the Oligocene and Miocene epochs, a time when the principal lineages were established, and that *Apis* apparently originated in Europe, spreading from there into Asia, Africa, and North America, with subsequent diversification in the former two regions and extinction in the latter. During the human migrations and colonization honey bees were once again introduced multiple times into the Americas, as well as into Australia and Asia.