Mesozoic stage of evolution of the nematocerous Diptera in context of contemporary biogeographical changes; importance of this group to the evolution of the order

The Mesozoic was an epoch during which the biogeographical changes were decisive for the ecosystems of modern world. This epoch had lasted c. 190 Ma; it had started with the end of the Permian (252 mln Ma ago) and terminated with the end of the Cretaceous (c. 66 Ma ago). A subject of our project are the Diptera Nematocera, a group of old families chosen for their plausible key importance to our understanding of the first stages of the Diptera evolution. First Diptera appeared in the Triassic (c. 245 Ma ago), on the supercontinent Pangea. The division of Pangea into Laurasia and Gondwana in the Lower Jurassic (c.190 Ma ago), and subsequent further fragmentation of these land masses had caused spatial isolation of new continents and changes in their climate and paleoenvironment; these factors had induced rapid radiation of some Dipteran lineages while other became extinct, being incapable of adaptation to new conditions and/or of competition with new fauna. In the Upper Cretaceous the families of Diptera Nematocera contained already genera known today.

Till now we do not know which of the Recent taxa are of most ancient origin, despite numerous studies involving also analyses based on molecular data. The problem may be solved only by studying old, fossil material. Quite recently the palaeoentomologists got access to new fossils preserved with exquisite accuracy: the inclusions in Cretaceous fossil resins (Lebanese, Spanish and Burmese amber). Entire bodies of the flies aged 135-100 Ma are preserved three-dimensionally, in the state almost as perfect as that of recent insects. Till now such inclusions were known only from much younger Baltic amber (40 Ma), or younger fossil resins (e.g., Dominican amber). The Cretacoeus inclusions offer a fascinating opportunity of investigation of all morphological details of so ancient Diptera and promise a breakthrough in our knowledge of their diversity and evolution. They also call for revision and re-considering of existing concepts on their phylogeny.

Therefore it is absolutely essential to our project to get access to these inclusions and to study them with as good equipment as possible. The phylogenetic analysis is based on characters defined by a researcher; the greater number of characters is introduced, the more reliable the output, i.e., a phylogenetic tree. Till now the analyses of so old species were based first of all on the venation of wings, which are usually the only traces of insects preserved in sedimentary rocks. Now the phylogenetic trees for particular families of Diptera will be uncomparably more accurate and rich in evolutionary events, such as as radiations and extinctions. The chronology of these events will be further related to biogeografic changes in contemporary world. The comparison of the dynamics of evolution in particular families will result in a general synthetic picture of evolution of Diptera, on family, generic and species level.