SYNINCLUSIONS AND 'FROZEN BEHAVIOR' IN AMBER – WHAT THEY CAN TELL US ABOUT THE EVOLUTION OF INSECT LIFESTYLES

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Insects show an extremely wide range of different lifestyles and strategies today, concerning e.g. reproductive aspects, care of eggs and young, or predation and defence. Also, very different modes of intraspecific interaction occur today – from a solitary lifestyle, to sociality in different degrees, to eusociality. The evolution of these lifestyles is highly debated in the literature for some insect groups, such as eusocial bees, ants, or termites, but also several sub-social or aggregating representatives of species of e.g. earwigs, grasshoppers, cockroaches and others. The majority of studies regarding the evolution of sociality and different lifestyles are mainly based on species living today. Information about fossil representatives is rare, but can add important aspects to these reconstructions and can provide information about the minimum age of specific lifestyles in deep time. We present new examples of insect syninclusions in Miocene, Eocene and Cretaceous amber, some of these representing cases of so-called 'frozen behaviour'. Cases of 'frozen behaviour' are especially of high interest for the reconstruction of behavioural aspects of extinct organisms, as these fossils are preserved in a specific moment, such as mating, feeding, oviposition, or hatching. However, the interpretation of these cases demands for a comprehensive comparison with observations of organisms living today. We present also examples of syninclusions of several individuals up to a mass occurrence of conspecifics of insect groups, which are usually not considered to show social interactions. Owlflies, as an example, are usually described to show a highly aggressive behaviour against conspecifics, but perform a form of group defense in early developmental stages today. New findings indicate that this strategy might already have been present in the Cretaceous. We discuss possible conclusions and limitations of the interpretation, based on syninclusions from different time periods relating to the evolution of lifestyles within insect groups.