Palaeontological and Biological Collections - Bridging the gap

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Abstract

Palaeontology and biology are closely related sciences, as are the collections associated with them. Nevertheless there are differences between the two types of collections and the scientific data that they yield with regards to taxonomy, climate and ecology. In order to bridge the gap between the two subjects, it is important to clarify what these differences are and how they can be used to supplement research that addresses future environmental/climatic issues. In biology, valuable traits of the whole organism serve for taxonomy. In the fossil record, a morphospecies concept needs to be used because specimens are mainly preserved fragmentarily and palaeontologists have to take advantage of morphological traits that are often disregarded by biologists. Another difference is that biological objects represent modern time, while the fossil record provides valuable information on a deep time perspective, i.e., in a third dimension. Yet, these two disciplines obviously depend on each other: while biologists provide palaeontologists with information about unfossilised soft parts, palaeontology can help to solve questions about life in the past.

Using four current case studies from the Stuttgart Natural History Museum, we provide examples of how biological and palaeontological information stored in museum collections are linterlinked, and particularly how palaeontology can help to solve current and future problems. We also highlight the potential of palaeontological collections and demonstrate
the necessity of digitizing large quantities of objects as well as the related basic
information. Case studies are:

1. Fossil leaves provide evidence for past atmospheric CO₂ levels and climate
change, which can be used for climate change models.
2. Fossils help to understand current and future hazards e.g., fossils embedded in
tsunami sediments can provide information on how tsunamis affect
shelf marine ecosystems.
3. Extensive taxonomic studies of Miocene land snails and the comparison with extant
relatives allow the reconstruction of fossil environments. Combined with
complementary methods, the biological, geological and meteorological factors
controlling these environments can be reconstructed.
4. Phylogenetic studies tell us how life evolved and how organisms have changed
through time. An important factor for phylogeny is the time-aspect, such as the
splitting of lineages. Phylogenetic trees based on modern taxa can only be
validated by fossils. We will present an example of insect phylogeny.

These case studies not only show how biology and palaeontology are interlinked, but the
first three studies are sound examples of how the knowledge of the past helps to
understand the present. Furthermore, the first two studies are highly relevant for predicting
the future. All of this information can only be used appropriately, if large proportions of data
are available that include information on geology and age. For this reason, the Access to
Biological Collection Data Extended for Geosciences (ABCD EFG) standard is so
important, as it extends the two-dimensional view (Recent) into a third dimension (deep
time).

Our vision is an integrated modelling of past, present and future scenarios, whether for
climate or ecosystem change, or geological hazards. Considering the deep time
information, we can model how changes would take place under natural conditions, i.e.,
without anthropogenic influence. This requires the availability of large data sets of
taxonomic information on the EFG level from all over the world.

Keywords

biology, palaeontology, collection data, digitisation, integrated modelling of the past and
future

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