The Evolution of the Paleoenvironments in Western Europe during the Cenozoic: a review

Berger Jean-Pierre

Dept. Geosciences-Geologie, Univ. Fribourg, Suisse. email: jean-pierre.berger@unifr.ch

Following the catastrophical event occurring at the K/T boundary, the biotic and abiotic conditions on Earth created a rapid re-development of the terrestrial and marine ecosystems. We will here principally discuss the evolution of these ecosystems and their environmental conditions during the Cenozoic, starting from the Paleocene 60 million years (Ma) ago, and ending with the Pleistocene glaciations. For timing reasons, this talk will be limited to the Western Europe, especially the Paris Basin, the North Sea and adjacent regions, the Rhine graben and the Molasse basin.

Globally speaking, this evolution is marked by a general warm climate during the Paleocene, culminating with the PETM (Paleocene/Eocene thermal maximum) at about 55 Ma and corresponding with an important change in the planktic and benthic fauna, and with an explosive radiation of mammals. This is for example well marked in the Paris Basin as well as in the North Sea region.

A general cooling trend is then observed until the end of Eocene, marked by the TEE (Terminal Eocene Event) in the marine realm and correlated with the “Grande Coupure” in the mammal record. These events are in direct correlation with the first glaciations in Antarctica. In Europe, the paleogeography changed also very rapidly during this time because of the development of the European Cenozoic Rift System (ECRIS, with the formation of the Rhine -, Bresse- and Limagne Graben) and of the North Alpine Foreland Basin (NAFB, with the Molasse basin) and the Paratethys.

Combined with the sea-level changes, this geodynamic frame induced a very complex succession of tropical-subtropical-temperate climates associated with various transgressive and regressive phases occurring during the Oligocene and Miocene. This story is particularly well expressed in the Rhine Graben (Messel, Pechelbronn Sea, Rupelian transgressive phase, Hydrobien- and Cerithium mass occurrences) and in the Molasse basin (marine and freshwater phases of the UMM, USM, OMM, OSM). The Oligo-Miocene boundary is marked, at least in the Molasse basin, by a temperature change and an “aridity event” (expressed for example by Palms and Taxodiaceous local extinctions). In the Middle Miocene, some faunal and floral changes are related to paleogeographical changes (for example “Proboscidian Event” and “Hipparion Event”) and other could be also related to the so-called “Monterrey Hypothesis” (between 13 and 17.5 Ma) and, at least locally, by volcanic events (Kaiserstuhl, Vogelsberg, Hegau) and by the impact of the Nördlinger Ries (14.6 Ma).
It is to be noted that these paleogeographic and paleoenvironmental reconstructions would be not possible without the help of Burkhard Engesser and his colleagues: the very precise biostratigraphic frame of the Molasse basin is essentially based on their studies.

The Mio-Pliocene is marked by important geodynamic phases (foreland uplift, Jura faulting) and by catastrophic events (Messinian Salinity Crisis, Sundgau Event). These events are certainly responsible for the end of the NAFB'story, as well as for a lot of morphologic features (for example in the Bresse and in the Jura). Their impact on the fauna and flora is still not clear, even if migration phases certainly occur between Africa and Europe when the Mediterranean Sea was dry.

Last but not least, the effects of the Arctic glaciations (2.6 Ma) and their consequences on land in Europe (with the different glacial/interglacial phases from at least 1.0 Ma to 10ky) clearly affect the land fauna and flora. The apparition and extinction of very well known mammal taxa (woolly Mammoth, woolly Rhinoceros, as well as Neanderthal) is an important consequence of this global and regional climate changes. Burkhard's book devoted to the mammoth evolution and the accompanying Pleistocene fauna gives a very nice view about this question.