

Sedimentary record and structural analysis of the opening of the European Cenozoic Rift System: The case of the Upper Rhine Graben

Justine Briais (1), Eric Lasseur (1), Catherine Homberg (2), Laurent Beccaletto (1), Renaud Couëffé (1), Nicolas Bellahsen (2), and Jean-Jacques Chateaufneuf (3)

(1) BRGM, Orléans, France (j.briais@brgm.fr), (2) IStEP, UPMC, Paris, France, (3) Biostratigraphy consultant, Orléans, France

The European Cenozoic Rift System (ECRIS) attests to an intracontinental rifting period attributed to the late Eocene-Oligocene period of time. The opening mechanisms of ECRIS still remain discussed, mainly because they took place during the regional compressive period related to the Africa-Eurasia convergence. Several geodynamic-related mechanisms are proposed, such as (1) a mantle activity, (2) an extension of the European plate related to the Alpine subduction (slab pull or slab roll-back), (3) a transtension related to strike slips induced by the Iberia-Eurasia and Apulia-Eurasia convergences.

Our study discusses the mechanism for opening the Upper Rhine Graben (URG), located in the middle part of the ECRIS. Using reprocessed seismic lines and well data, we carried out a detailed sedimentary infilling analysis coupled with a structural study of the graben and its borders. As a result, three steps are identified for its tectonic evolution:

(1) Lutetian-Bartonian: the first step of the opening is recorded by small lacustrine basins bounded by N060- and N010-020-trending inherited normal faults. These basins open either by transtension in a NS compressive context, or by NW-SE extension.

(2) Priabonian-Rupelian: the subsidence occurs at a wider scale; the geographic extension of the basin is larger than the current borders of the URG. The structure is controlled essentially by N010-20-trending normal faults and by N060-trending transfer faults. Three structural blocks, bounded by N060-trending transfer faults, are identified from north to south. Each structural block displays an E-W sedimentary filling asymmetry. This period records an NW-SE extension.

(3) Chattian-Miocene: the tectonic activity increases and a large-scale strike slip (sinistral) system takes place. This sinistral strike slip is contemporaneous with an uplift of the southern part of the URG and a rapid subsidence of its northern part. These events are related to compressive alpine constraints.

During the syn-rift period, the tectonic activity and the amplitude of the vertical movements are low compared to those of the post-rift period. Finally, the NW-SE extension is in the same axis as the NW-SE compressive alpine constraints, likely indicating a direct relation with the alpine dynamic.