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## Eocene-Pliocene time scale and stratigraphy of the Upper Rhine Graben (URG) and the Swiss Molasse Basin (SMB)

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**Abstract** We present a general stratigraphic synthesis for the Upper Rhine Graben (URG) and the Swiss Molasse Basin (SMB) from Eocene to Pliocene times. The stratigraphic data were compiled both from literature and from research carried out by the authors during the past 6 years; an index of the stratigraphically most important localities is provided. We distinguish 14 geographical areas from the Helvetic domain in the South to the Hanau Basin in the North. For each geographical area, we give a synthesis of the biostratigraphy, lithofacies, and chronostratigraphic ranges. The relationships between this stratigraphic record and the global sea-level changes are generally disturbed by the geodynamic (e.g., subsidence) evolution of the basins. However, global sea-level changes probably affected the dynamic of transgression–regression in the URG (e.g., Middle Pechelbronn Beds and Serie Grise corresponding with sea-level rise between Ru1/Ru2 and Ru2/Ru3 sequences, respectively) as well as in the Molasse basin (regression of the UMM corresponding with the sea-level drop at the Ch1 sequence). The URGENT-project (Upper Rhine Graben evolution and

neotectonics) provided an unique opportunity to carry out and present this synthesis. Discussions with scientists addressing sedimentology, tectonics, geophysics and geochemistry permitted the comparison of the sedimentary history and stratigraphy of the basin with processes controlling its geodynamic evolution. Data presented here back up the palaeogeographic reconstructions presented in a companion paper by the same authors (see Berger et al. in Int J Earth Sci 2005).

**Keywords** Rhine Graben · Molasse · Paleogene · Neogene · Stratigraphy

### Introduction

During the last decade, important progresses have been made in Tertiary stratigraphy and correlation. Different synthetic stratigraphic charts have been published (e.g., Berggren et al. 1995; Hardenbol et al. 1998; Steininger 1999). Some recent data slightly modify several boundaries (particularly owing to the extension of astronomically calibrated geological time scales into the Neogene and Paleogene; see Pälike and Shackleton 2003) that will be synthesized probably in 2005 (see Berggren et al. 2003).

A detailed stratigraphic frame is absolutely necessary to constrain geodynamic models. This stratigraphic study could thus be used to evaluate different geodynamic questions such as subsidence rates, uplift of Vogesen–Schwarzwald massifs or correlations between Upper Rhine Graben (URG)-rifting and alpine orogeny.

The charts presented here, for the URG and Western Switzerland, address two basic aspects:

A. The first aspect concerns the time scale, correlating biozones, magnetostratigraphy, sequence stratigraphy, chronostratigraphic units and the absolute time scale (Fig. 1). We present in this chart different correlations proposed by different authors, following the concept

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