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fan deltas. Smaller alluvial fans also formed at the northern basin margin. Both river systems drained into an axial river flowing towards the southwest, the reverse of the axial flow in the USM. The frequent occurrence of lacustrine limestone beds and lacustrine clastics suggest the former presence of numerous lakes on the alluvial plain. Several thin bentonite layers in the OSM of eastern Switzerland with ages from 15.4 to 14.4 Ma have been related to the volcanic activity in southern Germany. Despite the enormous progress achieved in the understanding of the sedimentary history of the Molasse Basin since the publication of the first palaeogeographic map by G. de Razumowsky in 1790, numerous questions concerning Molasse sedimentation and the depositional processes are still open. To mention but a few:

(i) The controversy of a possible link during the Rupelian of the Molasse Basin and the Rheingraben across the "Raurachian depression" (i.e. a connection of the Paratethys and the boreal seas) was reanimated by recent discoveries: paratethyan calcareous nannoplankton in the Rupelton of the Rheingraben and a nannoflora of Rupelian age in a karst fill in the Neuchâtel Jura Mountains.
(ii) Does the unconformity at the base of the Burdigalian really exist and if so, why is its duration beyond the resolution of biostratigraphic and paleomagnetic methods?
(iii) When did Molasse sedimentation end? What has happened since deposition of the last preserved Molasse sediments of Serravallian age (MN 9 = c. 11 Ma) and the Pleistocene glaciations i.e. during a time span of c. 10 Ma, equal to about a fourth of the Molasse period? Another puzzling discovery in this context is a micromammal fauna found in another karst fill in the Jura which reveals a Ruscinian (Pliocene) age!

The answers to these and other questions, and especially the construction of a much more detailed time framework will finally allow modelling of the depositional history of the Molasse Basin in relation to Alpine orogenic events with less ambiguities than at present.

The Tertiary strata of Molasse Basin and Rauracian Depression: Lithofacies development, subsidence and dynamic concept

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The main lithostratigraphic units of the Swiss Molasse Basin have been established a long time ago. These are from bottom to top: Lower Marine Molasse – Lower Freshwater Molasse – Upper Marine Molasse – Upper Freshwater Molasse. Along strike of the Molasse Basin, between lake Geneva and lake Constance, these groups show a more or less uniform character. On the contrary, the lithologies change dramatically

when crossing the Molasse from the footwall of the Alps (Subalpine Molasse) to the external foreland (Jura Mountains). The asymmetric cross section of the Molasse – that is rather a wedge than a basin – corresponds to the typical facies development in synorogenic foreland basins: thick coarse grained alluvial sediments in the proximal part change laterally into much thinner fine grained and sometimes evaporitic units.

Molasse geologists created a huge number of lithostratigraphically defined formations and members in the course of time, often mixed up with bio- and/or chronostratigraphic names. Significant biostratigraphic markers were and still are quite rare. For regional or even global correlations this descriptive stratigraphy puts up many problems. Exploration wells of the oil industry helped to solve correlation problems from east to west. Detailed heavy mineral analyses made paleogeographic reconstructions possible but the geological concepts were still quite static.

Today we try to understand foreland subsidence by testing different geodynamic models. What we need is a reliable correlation of international chronostratigraphy with the lithoformations of the Molasse Basin to quantify the subsidence history on an absolute time scale. Besides the direct stratigraphic informations from boreholes, quarries and natural outcrops we have a wide range of indirect implications for the understanding of the geodynamic history of the Molasse Basin. Some examples shall be presented to point out these possibilities. Above all reflection seismics and borehole geophysics are very powerful tools that have to be integrated today into a geodynamic concept.

Deformation of the Subalpine Molasse

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The Subalpine Molasse encompasses the strongly deformed southern part of the Molasse Basin which is overthrust by Helvetic and Penninic Alpine nappes.

In a general way the Subalpine Molasse forms an imbricate fan: thrust faults that dip steeply southwards at the surface level out at depth. In many instances the shaly UMM served as detachment horizon. Some of the thrust faults, as well as bedding within the thrust sheets form a marked structural discordance with the overlying basal thrust of the Alpine nappes (interpreted as disconformity due to erosional relief by some authors). In map view the thrust sheets are arranged en échelon with individual thrust sheets disappearing beneath the Alpine nappes going westward. The structural discordance, as well as some prominent folds oblique to the regional trend might be related to the geometry of the fluviatile fans which are characterized by very rapid lateral facies changes (e.g. from thick, competent conglomerate units to incompetent marly units).

The transition between Subalpine and Plateau Molasse is often developed as a classic triangle zone; it can be interpreted as a type of fault-propagation fold, in which a thrust fault terminates in the core of an anticline-syncline pair.