

Past and Present Tectonics of the western Alpine Molasse Basin between Jura and Prealpes Klippen

Jon Mosar, Tobias Ibele, Eva Matzenauer

Département de Géosciences, Université de Fribourg, Chemin du Musée 6, CH-1700 Fribourg,
Switzerland

e-mail: jon.mosar@unifr.ch; tobias.ibele@unifr.ch; eva.matzenauer@unifr.ch

Between the Jura fold-and-thrust belt to the North and the Prealpes Klippen belt to the South, the Western Alpine Molasse Basin forms a flexural, wedgetop basin that underwent several phases of tectonics events and appears to be tectonically active since the Tertiary, throughout the Quaternary into the Present. The Molasse foreland Basin extends from underneath the Prealpes Klippen belt into the Jura mountain range. The present limit between the Jura Haute Chaîne folds and thrusts and the Molasse Plateau is an erosional limit. Vertically the Molasse Basin includes a sedimentary pile of Tertiary age, Mesozoic platform series, and a polymetamorphic basement including Permo-Carboniferous troughs.

Combining published data with new interpretation of seismic surveys, distribution of earthquakes and new fieldwork data we can discriminate between structural features related to i] extensional events, ii] fold and thrust tectonics due to alpine compression, iii] neotectonic and active strike-slip faulting. Examples of the different structures and events will be presented and discussed.

Overall the cover series in the Molasse Basin s.l. (including Mesozoic and Tertiary series) are detached over the Triassic evaporite décollement from the basement and form gentle fault-related folds in the E, and more high amplitude fault-related folds in the West such as the Salève or the Ratz folds. In addition to folding and thrusting, field studies in the Tertiary Molasse series show two superposed tectonic strike-slip events. In the Prealpes Klippen we can discriminate between several successive events associated with folding and thrusting, but also postdating folding and possibly emplacement during the early Tertiary. The neotectonic or recent state of stress can be studied using faults, pebbles, deformation bands, SC shear zones and other kinematic indicators as well as earthquake distribution and focal mechanisms.

Some of the most outstanding structural features in the Molasse basin, Jura and Prealpes are strike-slip faults. Examples such as the Vuache fault (sinistral NS oriented) clearly are active faults affecting the cover series only (as shown by earthquake depth), whereas the La Lance fault (dextral NW-SE oriented) was shown to be active during the Quaternary. E of the city of Fribourg the Fribourg zone, which is part of the larger, N-S oriented Fribourg structure, also shows potential for an active fault of modest dimensions. Depth of earthquakes and new interpretation of seismic surveys show that the strike-slip faults concern the sedimentary cover, but do NOT continue across the Triassic décollement level into the basement. This does, however, not exclude possible soft links between faults in the basement and faults in the cover. Whereas the continuation of strike-slip faults from the Jura into the Molasse Basin can be documented very clearly, it remains to be discussed if these faults also extend via the Subalpine Molasse into the Prealpes Klippen.

We suggest that the western Alpine foreland has suffered and possibly is still experiencing a transpressive tectonic regime with a general NW-SE oriented compression causing the development of conjugated N-S sinistral and NW-SE dextral fault zones. Each zone develops as a complex Riedel system.