During top to the N thrusting of the Austroalpine and Penninic nappes the Mesozoic – Cenozoic sediments of the European continental margin were detached from its basement, stacked and thrusted to the N, until reaching their actual position on top of the Subalpine Molasse. This stack is known as the Helvetic nappe stack. The internal structure of the Helvetic nappe stack differs east and west of the Rhine Valley; e.g. the Swiss Säntis nappe contains only Cretaceous sediments, whereas the Vorarlberg Säntis nappe, holding the same tectonic position in the nappe stack, is build up by Jurassic and Cretaceous strata. Former studies supposed the presence of a major fault structure parallel to the Rhine Valley to decouple the tectonic evolution. Based on our data we alternatively trace these differences back to lateral level changes of the detachment horizons, caused by the reactivation of the lateral ramps and the differences in the original thickness of incompetent lower Jurassic basement strata in pre-existing Jurassic basins.

Plio-Quaternary deformation of the Jura mountain belt: a quantitative geomorphology approach

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The Jura mountain belt is the westernmost and one of the most recent expressions of the Alpine orogeny. The Jura has been well studied from a structural point of view, but still remains the source of scientific debates, especially regarding its current and recent tectonic activity. It is deemed to be always in a shortening state, according to old leveling data and neotectonic observations on paleo-meanders of the Doubs river. However, the few GPS data available on the Jura don't show evidence of shortening, but a small extension parallel to the arc. Moreover, the traditionally accepted assumption of a collisional activity of the Jura raises the question of its geodynamic origin. The Western Alps are themselves in a post-collisional regime and characterized by a noticeable isostatic-related extension, due to the interaction between buoyancy forces and external dynamics.

The quantitative morphotectonic approach coupled with neotectonic study applied to Quaternary deposits and speleothems aims to characterize the current tectonic regime of the Jura. In particular, the analysis of watersheds and associated rivers profiles allow quantifying the degree and the nature of the equilibrium between the tectonic forcing and the fluvial erosional agent. Slope profiles of rivers are controlled by climatic and tectonic forcing through the expression:

$$S = (U / K)^{1/n} A^{m/n}$$

(with U: uplift rate, K: erodibility, function of hydrological and geological settings; A: drained area, m, n: empirical parameters).

We present here a systematic study of these profiles coupled with a morphological study of oxbows, which help to identify and characterize the morphological evolution of rivers in response to vertical movements, hence potential tectonic forcing. Associated to this morphotectonic approach, the tectonic analysis of karst cavities located in the vicinity of the main faults of the belt, allowed to characterize tectonically active zones, both in terms of age and displacement's quantification.