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Tectonic paleostress and tectonic geomorphology in the close vicinity of the Pontarlier strike-slip fault system (Swiss and French Jura Fold-and-Thrust Belt)

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This work focuses particularly on the combined tecto-geomorphic and paleostress studies to decipher the style and orientations of tectonic stress fields and to detect their signatures in the present-day fluvial landscape in the northern Alpine Foreland. Two adjacent study areas across the northern Alpine Foreland, the westernmost part of Switzerland and the region of Pontarlier strike-slip fault system in the Swiss and French Jura fold-and-thrust belt, were respectively selected for the detailed tecto-geomorphic and paleostress analyses.

Using high resolution digital elevation model, the diverse geomorphic responses of fluvial landscapes to tectonic deformations were highlighted in the westernmost part of Switzerland on the basis of a combined analysis of hypsometric curves and integrals, transverse topographic symmetry index, and channel length-gradient index. This strategy was additionally supported by analysis of topographic-swath profiles and geophysical and sub/ surface geological data. The obtained results not only show clear indications of the importance role of tectonics in the landscape development, which can't be explained as being the results of variation in lithology and/or climate, but also provide convincing evidence of Cenozoic reactivation of some buried Mesozoic faults in the relatively deep subsurface.

The presence of sharp convex upward hypsometric curve with high hypsometric integral value, a noticeable drainage migration/deflection, and steep channel gradients with prominent knickpoints, which almost coincide in space with sudden variations in the depth of the subsurface geologic layers and in the geophysical properties, manifest the role of tectonic activity in the development of present-day landscapes in the westernmost part of Switzerland.

The paleostress analysis of new heterogeneous fault-slip datasets, together with new chronological field observations, through using the P-B-T-axes and Right Dihedral methods, have allowed reconstruction of successive tectonic events under which brittle deformations occurred in the region of Pontarlier strike-slip fault system. These events, which are well correlated with those recognized in the other parts of European Platform, composed of a sequence, from oldest to youngest, of N-S-trending strike-slip, NW-SE-trending extensional, NW-SE-trending compressional, and ~NW-SE-trending strike-slip stress deformations. They occurred prior to, during and after the onset of Jura folding and thrusting, and related to convergence and subsequent collision between the Adriatic microplate and Eurasia plate since Early Cenozoic times. The latest tectonic deformation event, derived from this study, shows similar stress style and direction to the present-day stress field given by the inversions of earthquake focal mechanisms.

Jury:

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