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Recent deformation in the frontal Jura fold-and-thrust belt from a deep-seated thrust fault: evidence from Late Quaternary fluvial terraces

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The Jura Mountains represent the outermost deformation of the ongoing Alpine orogen (Laubscher, 1972; Madritsch et al., 2010a). While previous studies have focused on nearby units (e.g. Upper Rhine Graben, Bresse Graben, Plateau Jura) to understand ongoing deformation, Late Quaternary to present deformation is still poorly constrained in the outermost edge of the Jura fold-and-thrust belt – the Besançon Zone – despite previously reported Quaternary uplifted fluvial terraces (Campy, 1984; Madritsch et al., 2010a-b) and recorded seismic activity, notably the 2004 Rigney M_L 4.8 earthquake near the town of Besançon.

This study aims to understand the active tectonic deformation in the area through mapping of geologic units and uplifted terraces along the Doubs River (Eastern France), carving the Besançon Zone from the northeast (Clerval) to the southwest (Besançon), and supported by luminescence dates from fluvial deposits. Multiple, truncated ridges lie parallel to the river, composed of anticlines of Mesozoic units bounded by northeast-southwest trending thrust faults, the northernmost of which is the Avant-Monts Fault (Madritsch et al., 2008; 2010a-b). On the slopes of these ridges, a flight of three fluvial terraces was mapped throughout the area, the lower two of which show uniformly-uplifted straths (1 m and 5 m respectively) above the riverbed, suggesting regional, large-wavelength recent tectonic deformation. Topographic and regional geologic sections show a long-wavelength anticline centered in the Besançon Zone. These observables, together with earthquake records, point towards the Avant-Monts Fault as the responsible thrust fault, continuing with depth and possibly being rooted in the Alpine orogen (Madritsch et al., 2008). Luminescence dating of an exceptional outcrop of terrace fill yielded an age of ~35 ka, thus an average large-wavelength uplift of 0.14 mm/yr. With this information, interpolation between terraces suggests ages of 7 ka and 140 ka for the higher and lower terraces.

These results show that the frontal Jura fold-and-thrust belt has been dominated by regional uplift from a deep-seated, slow slip thrust fault since the late Quaternary, which is accommodating the present-day shortening in the Jura Mountains from the ongoing Alpine collision.

References

Campy, M. (1984) Signification dynamique et climatique des formations et terrasses fluviales

dans un environnement de moyenne montagne. Bulletin de l'Association française pour l'Etude du Quaternaire 1, 87–92.

Laubscher, H. (1972) Some overall aspects of Jura dynamics. *Am J Sci* 272, 293–304.

Madritsch, H., Schmid, S. & Fabbri, O. (2008). Interactions between thin- and thick-skinned tectonics at the northwestern front of the Jura fold-and-thrust belt (Eastern France). *Tectonics* 27. 10.1029/2008TC002282.

Madritsch, H., Preusser, F., Fabbri, O., Bichet, V., Schlunegger, F., & Schmid, S. (2010a). Late Quaternary folding in the Jura Mountains: Evidence from syn-erosional deformation of fluvial meanders. *Terra Nova* 22, 147-154. 10.1111/j.1365-3121.2010.00928.x.

Madritsch, H., Fabbri, O., Hagedorn, EM. et al. (2010b). Feedback between erosion and active deformation: geomorphic constraints from the frontal Jura fold-and-thrust belt (eastern France). *Int J Earth Sci (Geol Rundsch)* 99, 103–122. <https://doi.org/10.1007/s00531-009-0468-7>