Timing of brittle deformation in the Jura mountains revealed by U-Pb calcite dating

LEONIE WEISS*[1], CATHERINE MOTTRAM[1], RANDALL PARRISH[1] AND JAMES DARLING[1]

[1]University of Portsmouth, School of Earth and Environmental Science, Burnaby Building, Burnaby Road, Portsmouth PO1 3QL
*(leonie.weiss@port.ac.uk)

The Jura fold and thrust belt makes up the northern external part of the Alpine orogeny and formed as deformation propagated from thick-skinned to thin-skinned during the collision of the European and Adriatic plates. The structures within the Jura fold-and thrust belt propagated from south to north during the mid-late Miocene. We address the timing, rates and duration of fault propagation and folding in the Jura. Here, we use the recently developed calcite U-Pb dating method to provide direct timing constraints for calcite crystallisation in fractures and as slickenfibres along structures. Samples from the NE internal Jura were characterised using Cathodoluminescence and Electron Backscatter Diffraction imaging and dated using the in-situ laser ablation ICP-MS technique. Calcite veins have low U contents (typically ≤0.5-5 ppm) and yield a spread of ages between Upper Cretaceous to Paleocene (87.2 ± 6.7 Ma to 65.1 ± 2.2 Ma), and early to late Miocene (18.1 ± 1.6 Ma to 10.3 ± 0.5 Ma). Sedimentation of the host rock occurred between 163– 145 Ma. Our younger calcite vein dates, therefore, preserve evidence for multiple periods of later fracturing and fluid flow events. Even within a single vein, two separate events are preserved with a hiatus of >60 Ma. This study highlights the complexity preserved within carbonate veins and provides insights into the potential for calcite to preserve evidence of multiple processes from early diagenesis, to fluid-migration and deformation through fracturing, folding, faulting and vein crystallisation events. The ages reported here provide direct constraints on the timescales for the deformational history of the Jura. Furthermore, our results contribute to the understanding of the structural evolution and rates of formation of fold and thrust belts.