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Along-strike partitioning of shortening on thrust-related folds, Northern Apennine mountain front, Italy

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Shortening in an active fold and thrust belt is partitioned along strike, but there are few geologic records with sufficient time resolution to demonstrate this partitioning and related fault slip unsteadiness. Here we report on fold limb rotation related to slip on blind thrust faults where partitioning and unsteadiness are revealed by rock-magnetic cyclostratigraphy in sections of Pliocene-Late Pleistocene synorogenic marine and continental growth strata at the Enza and Stirone rivers, Northern Apennine mountain Front, Italy. Growth of the Salsomaggiore anticline, revealed in the stratigraphy of the late Pliocene marine Stirone River section, displays unsteady forelimb rotation between 3.0-1.8 Ma, but sediment accumulation rates there are nearly constant, suggesting a disconnect between sediment accumulation and locally induced accommodation space caused by the thrust-related folding of the Salsomaggiore anticline.

In contrast, the growth of the Quattro Castella anticline $\sim$40 km SE along strike is revealed in a new chronology developed for 270 m of the Enza River section by combining magnetostratigraphy, bio- and lithostratigraphic correlations, and cosmogenic radionuclide (CRN) dating. This section has at least one magnetic reversal, interpreted to represent the Brunhes-Matayama boundary at 0.78 Ma in the basal AEI continental deposits that lie above the important Sabbie Gialle lithostratigraphic marker. Overall, the marine deposits below the Sabbie Gialle at the Enza reveal 34º of forelimb rotation of the Quattro Castella anticline. The overlying series of palustrine, debris flow, and fluvial deposits record an additional 19º of limb rotation. Dip changes in the upper part of the section occur as angular unconformities, as opposed to the predominantly progressive rotation observed in the marine part of the section. Like Salsomaggiore, the rates of fold growth at Quattro Castella are unsteady, though the magnitude of this unsteadiness is smaller than at Salsomaggiore. Correlation between the Enza and Stirone sections suggests much of the deformation at Quattro Castella occurred after $\sim$1 Ma, or after the Salsomaggiore anticline growth began to slow significantly. Thus, our study reveals not only the range of fault slip and fold growth unsteadiness, but the timing of shortening partitioning along strike from the Salsomaggiore to Quattro Castella structure.