

Kinematic History of Brittle Structures and Planar Fabrics in the Eastern Cordillera of Colombia Deduced from Multidisciplinary Evidence

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Structural analyses allow for the origins of fractures to be placed in a relative time framework with respect to folding and other mesoscopic structures. However, the timing of brittle deformation is rarely determined in an absolute chronological framework. In this collaborative study, orientation analyses of veins, fractures and planar fabrics are combined with fission track analyses, vitrinite reflectance (Ro) measurements, finite strain measurements, and fluid inclusion data. This multidisciplinary approach allows us to establish the timing of the systematic brittle deformation in several localities in the Eastern Cordillera of Colombia.

Structural, thermal, and thermochronological evidence suggests that most of the systematic brittle deformation in the localities analyzed occurred synchronous with planar fabric development (at peak burial temperatures) and therefore nearly synchronous with the onset of generalized exhumation in the Eastern Cordillera at about 25 Ma. Detailed comparisons with the kinematics of folding demonstrate that planar fabrics and brittle deformation are mostly related with early syn-folding to pre-folding strain under a similar stress regime that created the folds. These results are compared with regional constraints on the timing of hydrocarbon migration and accumulations in specific structures, yielding a positive window for the oil charge. The timing of brittle deformation can be compared with regional indicators of deformation, as identified by regional basin analysis. This comparison shows, at least for the studied areas of the Eastern Cordillera, that sedimentary processes in the basins record, almost immediately, a timing of deformation compatible with the direct indicators of brittle deformation