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Kinematic analysis of recent and active faults of the southern Umbria-Marche domain, Northern Apennines, Italy: geological constraints to geodynamic models

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The recent and active deformation that affects the crest zone of the Umbria-Marche belt (Northern Apennines, Italy) displays a remarkable extensional character, outlined by development of normal fault sets that overprint pre-existing folds and thrusts of Late Miocene-Early Pliocene age. The main extensional fault systems often bound intermontane depressions hosting recent, mainly continental, i.e. fluvial or lacustrine deposits, separating the latter from Triassic-Miocene, mainly carbonatic and siliciclastic marine rocks that belong to the Romagna-Umbria-Marche stratigraphic succession. Stratigraphic data indicate that the extensional strain responsible for the development of normal fault-bounded continental basins in the outer zones of the Northern Apennines was active until Middle Pleistocene time.
Since Middle Pleistocene time onwards a major geodynamic change has affected the Central Mediterranean region, with local reorganization of the kinematics in the Adria domain and adjacent Apennine belt. A wide literature illustrates that the overall deformation field of the Central Mediterranean area is presently governed by the relative movements between the Eurasia and Africa plates. The complex interaction of the Africa-Adria and the Anatolian-Aegean-Balkan domains has led the Adria microplate to migrate NW-ward and to collide against Eurasia along the Eastern Southern Alps. As a consequence Adria is presently moving with a general left-lateral displacement with respect to the Apennine mountain belt. The sinistral component of active deformations is also supported by analysis of earthquake focal mechanisms.
A comparison between geophysical and geological evidence outlines an apparent discrepancy: most recognized recent and active faults display a remarkable extensional character, as shown by the geometry of continental basin-bounding structutes, whereas geodetic and seismologic evidence indicates the persistency of an active strike-slip, left-lateral dominated strain field. The coexistence of extensional and strike-slip regimes, in principle difficult to achieve, may be explained in the framework of a transtensional deformation model where extensional components, normal to the main NW-directed structural trends, are associated to left-lateral strike-slip movements parallel to the main NW-directed structural trends.
Critical for the evaluation of the internal consistency of a deformation model for the brittle upper crustal levels is the definition of the kinematics of active faults. In this study we illustrate the preliminary results of a kinematic analysis carried out along 20, exceptionally well exposed, recent and active fault surfaces cropping out in the southernmost portion of the Umbria-Marche belt adjacent to its termination against the the Latium-Abruzzi domain to the East. The collected data indicate that the investigated faults reflect a kinematically oblique character, and that development of these structures may be explained in the framework of a left-dominated transtensional strain field. More important, the data indicate that fault kinematic analysis is an effective tool in testing geodynamic models for actively deforming crustal domains.