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Post Pyrenean temporal changes in the stress state of Eastern Provence (SE France): fault kinematics and regional implications

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Provence (SE France) is deformed due to a resultant force of the interacting Africa-Eurasia plate convergence and gravitational collapse of the Alps. During Cenozoic, changes in the balance of concurrent tectonic forces have changed both the geodynamics and kinematics of the involved areas. This study focuses on kinematic changes in a key area that expresses kinematic signatures of several post-Variscan deformation stages. The area of interest comprises small parts of both Western and Eastern Provence between the Mirabeau Anticline to the north, and Sainte-Victoire Mountain to the south. We investigate the evolution of the Cenozoic tectonic regimes of the area. We present evidence of drastic temporal changes in the stress state by the inversion of geological fault kinematics data that lead to identify five distinct stress states prevailing during the Cenozoic. The oldest kinematic signature belongs to the Late Cretaceous – Early Eocene Pyrenean contractional stage characterized by a NNE-trending compression. This period is separated from three distinct Alpine tectonic regimes by the Oligocene extensional period. The earlier Alpine stress state (paleostress) was active during the Early to Middle Miocene, with a mean N030$\pm$10°E-trending horizontal maximum stress axis (σ1). This represents a transpressional tectonic regime that changed to a mainly strike-slip tectonic regime (intermediate) characterized by a N140$\pm$10°E-trending compression in the Late Miocene. The youngest (modern) stress state shows a strike-slip tectonic regime with a regional mean of N178$\pm$15°E-trending horizontal σ1 that prevails since the Pliocene. The significant variations in the direction of Miocene compressions may imply an important change in the geodynamics of the Provence that is currently undergoing the resultant force of Africa-Eurasia convergence/gravitational collapse of the Alps. It is likely that, in this area, the Early to Middle Miocene stress state was influenced by the concurrent Ligurian Sea opening and the SSW-ward lateral extrusion of the western Alps that became the governing tectonic force in, at least, Eastern Provence.