



Surface expression of Cenozoic lithospheric deformation in the Alpine foreland.

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Two of the main topographic features of the Western and Central European platform are the European Cenozoic rift system (ECRIS) and the uplifted Variscan Massifs. ECRIS and the associated fault systems transecting the Variscan Massifs were activated in the foreland of the Pyrenees and Alps during the Eocene in response to the build-up of collision-related intraplate stresses. During Oligocene and Neogene times ECRIS evolved by passive rifting under changing stress fields, reflecting end Oligocene consolidation of the Pyrenees and increasing coupling of the Alpine Orogen with its foreland. ECRIS is presently still active, as evidenced by its seismicity and geodetic data.

Uplift of the Massif Central and the Rhenish Massif, commencing at the Oligocene-Miocene transition, is mainly attributed to plume-related thermal thinning of the mantle-lithosphere. Mid-Burdigalian uplift of the SW-NE striking Vosges-Black Forest Arch, that has the geometry of a doubly plunging anticline breached by the Upper Rhine Graben, involved folding of the lithosphere. Late Burdigalian broad uplift of the northern parts of the Bohemian Massif reflects lithospheric buckling whereas late Miocene-Pliocene uplift of its marginal blocks involved reactivation of pre-existing crustal discontinuities. Crustal extension across ECRIS, amounting to no more than 7 km, was compensated by a finite clockwise rotation of the Paris Basin block, up warping of the Weald-Artois axis and reactivation of the Armorican shear zones. Intermittent, though progressive uplift of the Armorican Massif, commencing in the Miocene, is attributed to transpressional deformation of the lithosphere.

Under the present-day NW-directed compressional stress field, that developed during the early Miocene and further intensified during the Pliocene, the Armorican Massif,

the Massif Central, the western parts of the Rhenish Massif and the northern parts of the Bohemian Massif continue to rise at rates of up to 1.75 mm/y whilst the Vosges-Black Forest arch is relatively stable.

Uplift of the Variscan Massifs and development of ECRIS exerted strong controls on the Neogene and Quaternary evolution of drainage systems in the Alpine foreland.