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Evolution of the European Cenozoic Rift System and Neogene uplift history of the Variscan Massifs in the Alpine foreland.

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The evolution of the European Cenozoic Rift System (ECRIS) and the Alpine orogen is discussed on the base of two retro-deformed lithospheric transects which extend across the Western and Central Alps and the Massif Central and the Rhenish Massif, respectively.

During the Paleocene, compressional stresses exerted on continental Europe by the evolving Alps and Pyrenees caused lithospheric buckling and basin inversion up to 1700 km to the North of the Pyrenean and Alpine deformation fronts. This was accompanied by the injection of melilite dykes, reflecting an increase of the potential temperature of the asthenosphere beneath the European foreland.

At the Paleocene-Eocene transition, compressional stresses relaxed in the Alpine foreland whereas collisional interaction of the Pyrenees with their foreland persisted. In the Alps, major Eocene north-directed lithospheric shortening was followed by mid-Eocene slab- and thrust-loaded subsidence of the Dauphinois and Helvetic shelves. During the late Eocene, north-drected compressional intraplate stresses origniating at the Central Alpine and Pyrenean collision zones built up again and activated ECRIS.

At the Eocene-Oligocene transition, the subducted Central Alpine slab was detached whereas the West-Alpine slab remained attached to the lithosphere. Subsequently the Alpine orogenic wedge converged northwestwards with its foreland. The Oligocene main rifting phase of ECRIS was controlled by north-directed compressional stresses originating at the Pyrenean and Alpine collision zones.

Following early Miocene termination of crustal shortening in the Pyrenees and open-

ing of the oceanic Ligurian-Provençal Basin, evolution of ECRIS was exclusively controlled by west- and northwest-directed compressional stresses emanating from the Alps during imbrication of their external massifs. Whereas the grabens of the Massif Central and the Rhône Valley became inactive during the early Miocene, the Rhine Rift System remained active until the present. Lithospheric folding controlled mid-Miocene and Pliocene uplift of the Vosges-Black Forest Arch. Progressive uplift of the Rhenish Massif and Massif Central is mainly attributed to plume-related thermal thinning of the mantle-lithosphere.

ECRIS evolved by passive rifting in response to the build-up of Pyrenean and Alpine collision-related compressional intraplate stresses. Mantle-plume-type upwelling of the asthenosphere caused thermal weakening of the foreland lithosphere, rendering it prone to deformation.