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A tomographic view on Western Mediterranean geodynamics

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We present an analysis of upper mantle structure as imaged in the recent seismic tomography model of Bijwaard and Spakman (2000) and discuss our inferences in the context of the tectonic evolution of the Western Mediterranean during the Cenozoic upto the Present. Our analysis leads to the following main results or conclusions: 1) The identification of a remnant of the West Alpine-Tethys (Piedmont ocean) found at the bottom of the upper mantle under the Alps and northern Apennines region. 2) A surface reconstruction of the Ligurian ocean from subduction remnants found in the upper mantle under the Western Mediterranean. 3) The confirmation of the earlier propositions by Lonergan and White (1997) concerning slab roll-back and lithosphere tearing which led to two dominant Ligurian subduction systems: the Betic-Alboran subduction and the Apennines-Calabria subduction. 4) Propositions of a short (300-400 km) continuous north-Apennines slab and of slab detachment beneath the central-southern Apennines. 5) Slab detachment and lithosphere tearing are considered crucial processes for facilitating slab roll-back in the Western Mediterranean region. 6) A new kinematic model for slab roll-back in the Betic-Rif-Alboran region which involves slab detachment under the Betic, lithosphere tearing along the African margin, and which explains both the inferred slab geometry and the arcuate geometry of the Betic-Rif orogen. These findings on lithosphere-mantle evolution provide a large-scale geodynamic context which may assist in the interpretation of the present state of crustal deformation in the Western Mediterranean region.