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The role of Variscan to pre-Jurassic active extension in controlling the architecture of the rifted passive margin of Adria: the example of the Canavese Zone (Western Southern Alps, Italy)

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The Canavese Zone, in the Italian Western Southern Alps, represents the remnant of the Jurassic syn-rift stretching, thinning and dismemberment of the distal passive margin of Adria during the opening of the Penninic Ocean (i.e. Northern Alpine Tethys). Our findings, based on detailed geological mapping, structural analysis and stratigraphic and petrographic observations, document however that the inferred hyper-extensional dismemberment of this distal part of the passive margin of Adria, up to seafloor spreading, was favored by the inherited Variscan geometry and crustal architecture of the rifted margin, and by the subsequent Alpine-related strike-slip deformation. The new field data document, in fact, that the limited vertical displacement of syn-extensional (syn-rift) Jurassic faults was ineffective in producing and justifying the crustal thinning observed in the Canavese Zone. The deformation and thinning of the continental basement of Adria are constrained to the late Variscan time by the unconformable overlying of Late Permian deposits. Late Cretaceous-Early Paleocene and Late Cenozoic strike-slip faulting (i.e. Alpine and Insubric tectonic stages) reactivated previously formed faults, leading to the formation of a complex tectonic jigsaw which only partially coincides with the direct product of the Jurassic syn-rift dismemberment of the distal part of the passive margin of Adria. Our new findings document that this dismemberment of the rifted continental margin of Adria did not simply result from the syn-rift Jurassic extension, but was strongly favored by the inheritance of older (Variscan and post-Variscan) tectonic stages, which controlled earlier lithospheric weakness. The formation of rifted continental margins by extension of continental lithosphere leading to seafloor spreading is a complex and still poorly understood component of the plate tectonic cycle. Geological mapping of rifted continental margins may thus provide significant information to better understand and model the related processes, and explain the geometry of those margins as observed by means of seismic imaging.