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Role of Variscan tectonics inheritance in the Jurassic rifting of the passive margin of Adria: insights from the Canavese Zone (Western Southern Alps, Italy)

Sara De Caroli (1), Andrea Succo (2), Arianna Centelli (1), Edoardo Barbero (1), Alessandro Borghi (1), Gianni Balestro (1), and Andrea Festa (1)

(1) University of Turin, Department of Earth Sciences, Via Valperga Caluso, 35 - 10125 Torino, Italy., (2) University of Parma, Department of Chemistry, Life Sciences and Environmental Sustainability, Via Accademia delle Scienze 157/A - 43124, Parma, Italy.

The formation of rifted continental margins by extension of continental lithosphere leading to seafloor spreading is a complex component of the plate tectonic cycle. Geological mapping, supported by multidisciplinary analyses 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. We present here our new findings on the Canavese Zone (Italian Western Alps), which is inferred to represent the remnant of the Jurassic syn-rift stretching, thinning and dismemberment of the distal passive margin of Adria, occurred during the opening of the Northern Alpine Tethys. Through multiscale and multidisciplinary, field- and laboratory-based structural, stratigraphic and petrographic studies (from geological map scale to mesoscale and microscope scale), we document that the tectonic 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. Our findings show the existence of two different tectonic units of the pre-Variscan basement, which were deformed, juxtaposed and exhumed already during the Variscan orogeny as constraint by (i) intrusion of early Permian granitoids, (ii) emplacement of volcanic rocks and (iii) unconformable overlie of Permian deposits on those metamorphic units. The syn-extensional (syn-rift) Jurassic faults, which affect the Mesozoic sedimentary succession, show only limited vertical displacement that was ineffective in producing and justifying the crustal thinning observed in pre-Variscan basement units. Finally, 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.