The Meliata and Piemont-Ligurian rifted margins: stratigraphic record and tectonic evolution of polyphase rift systems

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The Late Permian to Late Jurassic paleogeographic evolution of the Alpine domain was strongly controlled by the formation of polyphase rift systems. If these rift systems are the result of a single, long lasting rifting event or if they are generated by two distinct rift pulses is still a matter of debate. Recent studies seem to agree on the second hypothesis, supporting two distinct rift events: one Early-Middle Triassic (Meliata s.l.) and one Early to Middle Jurassic (Piedmont-Liguria s.l.). Nevertheless major incertitude arises on the interpretations of the evolution of the former rifting, which leads to either multiple or one single, continuous ocean branch. This uncertainty is mainly due to the successive orogenic overprint related to the formation of the Alpine belt and of the Western Mediterranean domain. The aim of this work is to explore how rifting events are recorded by the stratigraphic and structural evolution using both the vast existing literature and own observations. Selected areas belonging to different paleogeographic domains in the Alpine realm (Southalpine, Briançonnais s.l. and Austroalpine) will be studied in order to define relevant time-marker levels to map and correlate the temporal and spatial evolution of rift events. With this “basinal” approach we point to major tectonic events, filtering smaller-scale tectonics and minor environmental controlling factors on sedimentation. Our final goal is to identify the “fingerprints” for major rifting events that may enable to map the location and timing of hyper-extended domains. The evaporitic successions, the onset of thick carbonate platforms, their demise or drowning, the iron-manganese hardgrounds sedimentation (that may represent a response of hydrothermal circulation associated with hyper-extension) may correspond to correlable and mappable residues of large-scale rift events. These observations, together with data of the subsidence history, exhumation of basement rocks and magmatic evolution may provide a major, well-constrained framework that can be used to compare the evolution of the Alpine domain with that of present-day rifted margins.

Stratigraphic architecture and correlation of rifting-related deposits of potential conjugate distal margins: the Ligurian Prepiedmont-Piedmont (I) and the Lower Austroalpine (CH)

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Major rifting within the Alpine domain was active since the Late Triassic and led to the exhumation of subcontinental mantle and the formation of an embryonic oceanic domain during Late Middle Jurassic time (~165Ma). The rift history is recorded in several sectors of the Alpine belt, where complete pre- to postrift successions are preserved. These successions record the evolution of different sedimentary basins, showing different architectures and sedimentary evolutions. Today they are preserved in different Alpine domains and at different structural levels in the Alpine nappe pile as a result of the Alpine collision. In this work, we focus on the sedimentary successions of different domains of the former distal rifted margins: those belonging to the Ligurian Prepiedmont and Piedmont domains, outcropping in the Ligurian Alps in Italy (European margin) and those belonging to the Lower Austroalpine exposed in the Central Alps in SE Switzerland (Err, Bernina units; Adria margin). We chose these domains because of the completeness and the correlatability of the sedimentary successions. We aim to test if, with a certain degree of approximation, these areas can be considered as part of a former "conjugate" rift system and if sedimentation shows evidence of continuity along composite sections across these domains. The two margins are characterized by sudden drowning of a Late Triassic to Early Jurassic shallow-water carbonate platform into a Lower Jurassic carbonate ramp. In the Ligurian Prepiedmont the drowning event is dated as Lower Hettangian to Lower-Middle Sinemurian and it is characterized by the deposition of discontinuous condensed deposits (Fe-Mn hardgrounds). This level has a good correlation potential through both the sections. The following external-platform to ramp carbonates deposited in different basins, more or less subsident (e.g. Arnasco-Castelbianco). Locally, they are followed by huge amounts of coarse breccias, fed by the progressive activation of fault-scarps during the ongoing deformation in highly subsiding troughs. At the same time, ramps with moderate gravity flows formed in the areas directly facing the future exhumation zone (i.e. Lencisa, Bardella sections) testifying its progressively deepening trend. The sedimentation was interrupted by successive episodes of condensation, in the Upper Sinemurian and in the Pliensbachian. At the scale of the basin, these events show quite a good correlation considering selected areas. Successively, accommodation space was created especially above the major exhumation fault(s). The portion of the margin closely-facing the exhumation area was dismembered in blocks, (extensional allochthons; e.g. Piz Alv, Piz Bardella) while just above the main exhumation area, a depression formed (outer trough) hosting a composite sedimentation made up of deep water deposits (calcschists) and slices of exhumed serpentinite (Montaldo Unit). Thus, despite of all the complications that may be introduced considering local basin subdivision, the general stratigraphic framework in the two study areas is pretty well comparable and shows a first-order similar evolution of the sedimentation during the initial stage of rifting, beginning to clearly differentiate only after the exhumation stage. In addition, we recognize some new elements for a more accurate stratigraphic correlation of synrift deposits. These data lead us to consider that the studied sections can be approached as "conjugate" domains within an evolving rift system, with a good degree of continuity in stratigraphy and in sedimentological features.

Geochronology of Alpine shear zones in the Mont Blanc region using $^{40}Ar/^{39}Ar$ step-heating and Rb-Sr microsampling techniques

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Timing of deformation in the Mont Blanc massif in the western Alps and the understanding of its structural evolution, especially with regard to its recent exhumation, remains a matter of debate. Ductile deformation in the Mont Blanc region lasted from Oligocene to Late Miocene times, resulting in the development of the Helvetic nappe stack, with the Mont Blanc massif forming a crustal-scale fold-nappe. Generally NW-directed thrusting interacts with dextral transcurrent movements related to the Rhône-Simplon fault along the Chamonix valley and the Val Ferret on the internal side of the Mont Blanc massif. This case study presents geochronological data from 11 sample locations collected at 6 key areas in the Mont Blanc-Aiguilles Rouges region, which represent different stages in the tectonic evolution of the area. The $^{40}Ar/^{39}Ar$ step-heating method on white mica and the Rb-Sr microsampling method on texturally-controlled, µg-sized white mica - calcite pairs in textural equilibrium were applied to samples collected from individual low-grade shear zones with the aim of obtaining direct constraints on ages of deformation from synkinematically grown or recrystallized minerals. The results are critically assessed with respect to cooling versus neocrystallization ages and their assignment to distinct periods of tectonic activity in the Mont Blanc area is