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large-scale structural pattern as the result of the interplay between compression and extension during chain building: the case of the Sicily Belt (Central Mediterranean)

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There are very close relationships between chains building and contemporaneous basins formation in terms of spatial and structural interdependence, mutual compensation of sediments, tectonic interaction and simultaneous evolution. In fact, extensional tectonics has been worldwide documented as a process that contributes to the evolution of orogenic belts.
The dynamics of wedge growth may partly dictate by localised extensional forces which may support basin formation both in the back of the wedge (piggy-back basins) and in its toe region (foredeep-foreland basins).
The evolution of chain-foredeep-foreland systems is characterised by contractional structures coupled by extensional deformations, both at the chain-foredeep and at the foredeep-foreland transition zone. As a consequence, the architecture of most foredeep depressions is generally envisioned as controlled by active regional thrusts and coeval subsidiary normal faults in their inner and outer edges. These structures may contribute to accommodate flexure of foreland plates induced by the load of advancing thrust sheets.
The connection between thrusting-and-folding evolution (including thermal and mechanical perturbations of the continental lithosphere induced by mountain building) and the wedge failure towards the extensional collapse in collisional settings is poorly argued and two main different models are known: I) syn-orogenic extension (extensional tectonics contemporaneous with shortening induced by the overstepping at the back of an accretionary wedge during continuous deeper subduction) and II) post-orogenic extension (often explained as the result of crustal change in stress path related to gravitational collapse of the previously thickened and thermally weakened lithosphere). Syn-orogenic extension observed during the build-up of the mountain belt is usually restricted to the upper brittle crust and to the brittle-ductile transition.
A kinematic model relative to the chain building lack for the Sicily Belt, including folding-and-thrusting and extension interactions.
Sicily, located in the Central Mediterranean, is considered as part of the Tertiary Alpine-Himalayan suture zone. The Sicilian Thrust System (STS) is a south-verging fold-and-thrust belt and represents the South-eastern arcuate portion of the Apennine-Maghrebides thin-skinned fold-and-thrust belt. The STS is made of a lot of thrust sheets, including Mesozoic-Lower Tertiary pre-orogenic multilayered sedimentary sequence and occupies the larger part of the island. The thrust stack owes its origin to the deformation of pre-orogenic strata deposited in different palaeogeographic domains belonging to the Northern Africa passive margin. The belt developed during the Neogene, following the closure of the Tethys Ocean and the continental collision between the Sardo-Corso Block and the Africa margin.
The thrust pile was detached from the underlying basement during Miocene-Pliocene time interval and experienced both faulting, folding and stretching. A general hinterland-to-foreland thrust propagation is recorded in the syn-orogenic deposits.
The recognised regional-scale structural setting allow us to reconstruct tectonic evolution: I) piggy-back thrusting from the early Oligocene to the Langhian, inducing the building of the Inner Sicilian Chain (ISC) that migrated progressively forelandwards. Extensional deformations were active only in the foredeep-foreland system; II) piggy-back thrusting from the Langhian to the Tortonian, inducing the building of the Middle Sicilian Chain (MSC) that migrated progressively forelandwards. Extensional deformations were active both in the foredeep-foreland system and in the ISC as the result of incipient supercritical wedge taper conditions; III) wedge failure (ISC+MSC) from

the Tortonian to the earliermost Pliocene, inducing generalised extensional deformations in the chain-foredeep-foreland system; IV) new onset of piggy-back thrusting since the early Pliocene for renewed subcritical wedge taper conditions, allowed the building of the Outer Sicilian Chain (OSC) and out-of-sequence thrusting in the previous emplaced ISC and MSC. Extensional deformations were active only in the foredeep-foreland system; V) starting from the late Pliocene, strike and normal/oblique normal deformations affected the ISC and MSC as the effects of the Southern Tyrrhenian Basin dynamics.