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Role of the structural inheritance in formation of the Nice subalpine chain, interpreted from paleostress inversion and structural observations

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The so-called “arc de Nice” is the southernmost subalpine chain. Its southern boundary lies upslope from the northern Ligurian margin, along the present-day coastline. This subalpine chain is a fold-and-thrust belt formed by thrust-sheets of Mesozoic and Cenozoic terranes detached from their crystalline basement and translated southward above a Triassic evaporitic décollement. The belt was structured during three main tectonic events. A first Oligocene ENE-WSW shortening formed NNW-SSE trending folds; followed by an extensive event, the Ligurian Sea opening from 34 to 15 My, and then a Miocene N-S shortening was responsible for the setting up of south verging thrusts.

One site, located at St-Jean Cap-Ferrat, presents numerous and exceptional tectonic evidences of both the opening of the Ligurian Basin and the two stages of compression. A paleostress analyses was conducted to determine rigorously the stress directions associated with these different tectonic events.

The structural analysis of the site of St-Jean Cap-Ferrat and surroundings deserve a new interpretation of both (1) the level of deformation related to the ENE-WSW Oligocene compressive event and (2) the modalities of southward propagation of the Nice belt during the N-S Miocene compressive event. The first compressive event of deformation was accommodated both by folding and thrusting of the Meso-Cenozoic cover. Serial E-W cross-sections suggest west verging thrusts accompanied by mechanical decoupling not only on the known Triassic gypsum layer but also on the early cretaceous black shales. Our observations and paleostress measurements support that the southward propagation of the frontal thrust was prevented by E-W sub-vertical inherited normal faults (Tethyan or Ligurian or both?) located near the present-day shoreline. The southward displacement of the Nice belt was transferred on these normal faults reactivated as sinistral-lateral inverse strike-slip faults. Therefore, our analyses show that: (1) the inherited structures control the development of the Nice fold-and-thrust belt and (2) the southern boundary of the belt coincides more-or-less with the present-day shore line, the compressive Miocene deformation did not reach the northern Ligurian margin