An example of a three-type interference pattern in the Tuscan Nappe, Southeastern sector of Apuan Alps (Northern Apennines, Italy)

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The study area is located in the Northern Apennines, which is composed of oceanic and continental-derived tectonic units, stacked toward NE during Apennine subduction (Oligocene to present). The continental-derived units, representative of the Adria paleomargin involved into the collisional phases of the Alpine orogeny, are, from the lower to the upper structural levels: the Apuan Alps Unit, the Massa Unit and the Tuscan Nappe.
The Apuan Alps Unit consists of pre-Mesozoic metamorphic basement and metasedimentary cover rocks, ranging from Triassic to Oligocene, deformed and metamorphosed under greenschists facies conditions. The Massa Unit, is also characterized by pre-Mesozoic metamorphic basement unconformably covered by Middle to Upper Triassic metasedimentary rocks. It recorded higher metamorphic conditions respect to underlying Unit. The Tuscan Nappe, instead, is detached from its basement and it is composed by Late Triassic to Early Miocene non-metamorphic sedimentary rocks. This Unit was deformed at shallow structural levels.
In the southeastern sector of the Apuan Alps, sedimentary rocks of the Tuscan nappe crop out. Particularly, in the study area, this unit includes only LateTriassic - Early Cretaceous rocks (Carosi et al., 2005). Field observations and structural data allowed us to elaborate a 1:5.000 scale structural map. Structural analyses highlighted a comlplex deformation history, composed by five deformation events (from D1 to D5), documented a different scale. The D1 event is testified by S1 foliation classifiable as slaty cleavage. In thin section, S1 is emphasised by preferential orientation of phyllosilicates and lenticular domains composed of quartz, calcite, detrital micas, albite and oxides. Open to isoclinal similar folds (F2) with NW-SE trending axes are associated to the D2 event. F2 folds are associated to a well developed S2 axial plane classifiable as crenulation cleavage without significant re-crystallisation. The D3 event is not well developed in this area and it is locally recorded in the fine-grained rocks where it produced isoclinal folds with scattered axes and axial planes oriented N-S. The previous architecture is reworked by folds with chévron geometry and sub-horizontal axial plane associated to the D4 event. Finally, D5 event is characterized by open folds with sub-vertical axial plane and three systems of normal to transtensive faults. These brittle structures, could be interpreted as conjugate faults of the Monte Croce-Pescaglia faults system.
In conclusion, field observations and structural analysis conducted both at the micro and at the mesoscopic scale, indicate that Tuscan Nappe exposed in the study area was affected by a km-scale three-type interference pattern (Ramsay, 1967). Furthermore, our studies suggest that the faults played a role of great importance in the present architecture of this sector of the belt.

References

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