

The Southern Alps east of the Giudicarie Belt: Did they really act as an indenter?

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According to Ratschbacher et al. (1991) the eastern part of the south directed fold and thrust belt of the Southern Alps located east of the Giudicarie Belt acted as a rigid indenter responsible for the exhumation of the Tauern Window and the eastward lateral extrusion of the Austroalpine nappe pile in the Miocene. However, there is an apparent contradiction in that the Dolomites indenter is itself part of the Southern Alps fold- and thrust belt and hence far from being rigid. Realizing that different parts of this fold- and thrust belt became deformed during distinct deformation events during different time intervals helps to solve this dilemma.

In the Lombardian Southern Alps to the west, and along the kinematically linked sinistrally transpressive Giudicarie fold- and thrust belt, most of the south-directed thrusting occurred twice. Important thrusting occurred before the oldest intrusions of the Adamello pluton (before 45Ma), in the innermost parts of the Lombardian Southern Alps, very probably during the Late Cretaceous (94-78 Ma) as is suggested by the occurrence of flysch deposits whose detritus had its source in the Austroalpine units: the Late Cretaceous Lombardian flysch found along the foothills adjacent to the Po Plain and the remnants of this same flysch belt also found along the northern segment of the Giudicarie line. A second event occurred during the Miocene that postdates 22 Ma (age of the youngest marine sediments affected by sinistral transpression within the Giudicarie Belt), kinematically linked to the frontal-most thrust sheets of the Lombardian Southern Alps (figure 1). Schönborn (1992) quantified the amount of this post-Adamello Miocene N-S shortening to some 56km increasing eastward to some 87 km. Much of this Miocene N-S convergence is accommodated by northward wedging and underthrusting of the crystalline underpinnings of the fold-and thrust belt below the Central Alps and shallower parts of the preexisting about 30 Ma old Tonale Line (Schmid et al. 1996). The Giudicarie fold-and thrust belt, however, sinistrally displaced the entire crustal section of the eastern Southern Alps by about the same amount, i.e. some 72km (68km N-S component) to the north (Pomella et al. 2012). This resulted a sinistral offset of the pre-existing Tonale line in respect to the Pustertal segment of the Periadriatic line, associated with suspected indentation and rapid exhumation of the Tauern Window.

Deformation in the eastern part of the Southern Alps fold-and thrust belt (the Dolomites), however, occurred during entirely different time intervals. Parts of the Dolomites were affected by Dinaric SW-directed thrusting at 48-32Ma when the external Dinarides extended into the yet unfolded strata of the future Dolomites. After some 8 Ma of quiescence Miocene deformation in the Dolomites did initiate after the Langhian (i.e. after ca. 14 Ma) in the Dolomites as indicated by the youngest sediments involved along the Val Sugana thrust system (Castellarin et al. 1992, 1998). From a structural point of view the Val Sugana thrust system of the Dolomites ends westward before reaching the Giudicarie fold and thrust belt to which it is kinematically unrelated. The end of the suspected indentation of the Dolomites indenter, and hence sinistral transpression along the Giudicarie belt, can be estimated on the basis of the end of fast cooling in the Tauern window due to exhumation at around 14 Ma (Scharf et al. 2013).

In conclusion, it appears that indentation occurred during the 22-14 Ma time interval when the Dolomites east of the Giudicarie Belt remained undeformed and indeed acted as an indenter.

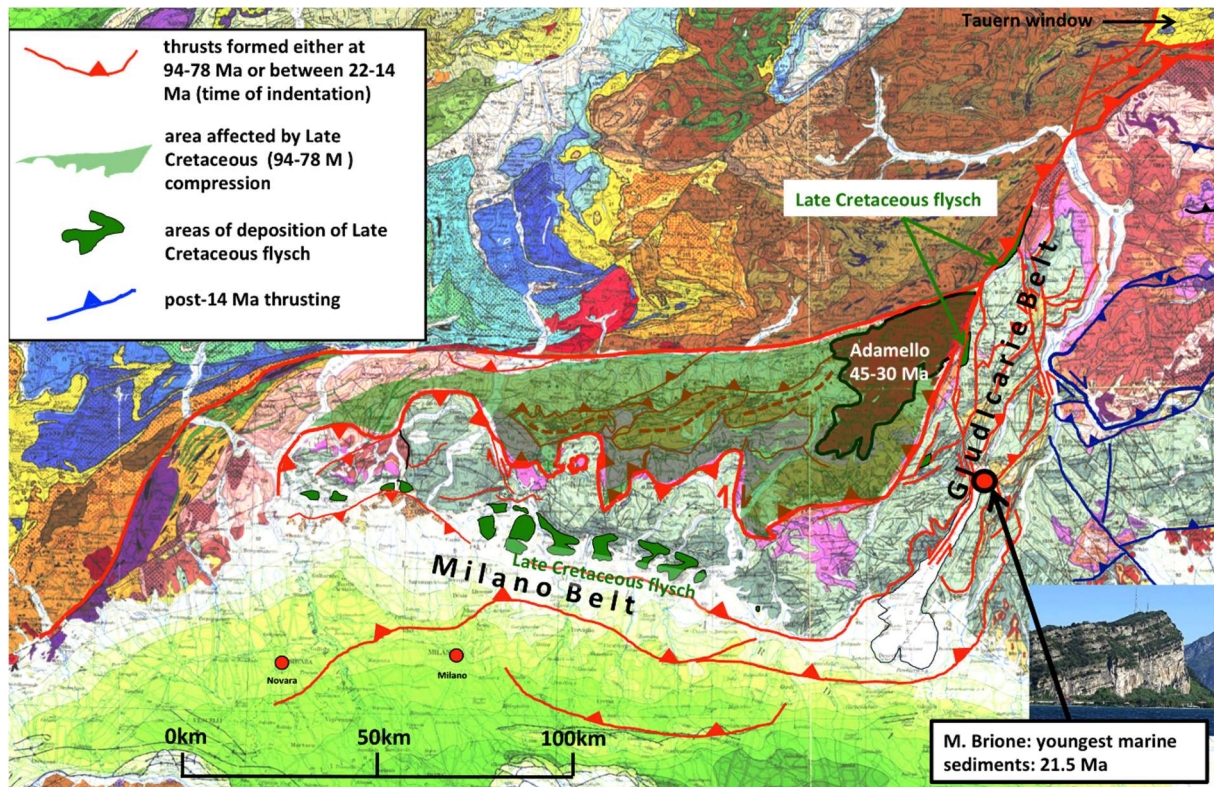


Figure 1: Note that the frontal part of the Lombardian Southern Alps (Milano Belt) south of the area deformed during Late Cretaceous times (green), deformed during the 22-14 Ma interval curves into the SSW-NNE striking Giudicarie Belt. Deformation of the indenter (blue lines) occurred after 14 Ma. Background map: Structural Model of Italy sheet Nr. 1 (Bigi et al. 1990).

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