



Modes of nappe emplacement in thrust belts: The Apennines, Italy

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In this study, we build on previous work on the Calabrian accretionary wedge (Polonia et al., *Tectonophysics*, 2016) and the formation of orogenic arcs, to address the emplacement of nappes in thrust belts along convergent margins. The emplacement may pertain to individual nappes as well as to nappe stacks.

Key in our analysis is recognizing the possible role of STEP faults (the surface expression of lithospheric tearing at slab edges; Govers and Wortel, *EPSL*, 2005) in controlling the emplacement process. It leads us to distinguish three modes of emplacement of nappes or nappe stacks, two of which are identified on the basis of the role of STEP faults and differences in their propagation paths. In spite of the differences, these two modes share a close association with strike-slip faulting. The third mode is the familiar (non-STEP-related) frontal mode, adequately represented in 2D cross-sections perpendicular to the continental margin involved.

We show that the Apennines are a remarkable natural laboratory to study the three emplacement modes; each mode can be identified on the basis of field observations and the lithospheric-scale geodynamic evolution of the Tyrrhenian-Adriatic region. The STEP-related modes account for the observed tectonic transport directions relative to the orientation of the continental margin, and the variability therein. Jointly, the results of our analysis shed light on first-order features of the thrust belt as a whole, in particular the differences in cylindricity between the Northern Apennines and the Southern Apennines (with implications for seismicity and hydrocarbon accumulation) and the formation of separate arcs as part of the overall thrust belt, such as the “buried arcs” beneath the Po-plain. Our findings contribute to increased understanding of depth-surface relationships, and being of generic nature, they are also relevant to other thrust belts along convergent plate boundaries.