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Early forefront exhumation in an erosive subduction complex: insights from the Northern Apennines of Italy

F. Remitti (1), P. Vannucchi (2), M.L. Balestrieri (3), and G. Bettelli (1)

(1) Dipartimento di Scienze della Terra, Università di Modena e Reggio Emilia, Modena, Italy (francesca.remitti@unimore.it), (2) Dipartimento di Scienze della Terra, Università di Firenze, Firenze, Italy , (3) IGG-CNR, Firenze, Italy

Stratigraphic and structural data indicate that, at the beginning of the Miocene, the frontal part of the subduction complex of the Northern Apennines was removed and incorporated in a subduction channel formed during ongoing continental subduction.
This stage follows the cessation of the growth of the accretionary prism by offscraping, occurred in the middle Eocene. The switch to subduction dominated by frontal tectonic erosion, lasting at least to the middle Miocene, was followed by the exhumation of the chain.
The exhumation history associated with accretion and retreat of the Northern Apennines has been analyzed through apatite thermochronology. The internal part of the chain started to be exhumed at 10-13 Ma, while the core of the Apennines began only at 8 Ma.
Here we present new structural and thermochronological data from a tectonic mélange involved in the shallow part of the plate boundary. This mélange is composed by blocks dated from Late Cretaceous to late Oligocene. All the samples analyzed were exhumed starting at 22-17 Ma (early Miocene), hence the exhumation of the mélange occurred after short time period from its incorporation in the subduction channel and before its deactivation. Our data show that during the early stages of continent-continent subduction two simultaneous and apparently competing mechanisms were particularly actives: i) frontal and basal tectonic erosion leading to the development of a subduction channel, and ii) occasional shallow underplating leading to early exhumation of portions of the channel closely inboard. As both tectonic erosion and internal thickening, the last resulting in underplating, coexist during wedge development, they account for space variations in strain localization and material transfer.