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# The response of periglacial landscape to Late Pleistocene active thrusting: evidences at the Po Basin-Northern Apennines hinge (Lombardy, Italy)

**Chiara Zuffetti** and Riccardo Bersezio
University of Milan, Department of Earth Sciences, Milano, Italy (chiara.zuffetti@unimi.it)

The palimpsest landscape and stratigraphic architecture of the Quaternary Po Foreland Basin record the tectonic pulses of the N-Apennines fold-and-thrust belt (the southern basin floor and active structural margin) and the glacial dynamics on the Alps (the northern basin floor and margin). Climate-controlled sediment flux from the glaciated Alpine side of the basin accommodated in the mobile setting driven by Apennine N-wards thrusting. Deciphering the nature, hierarchy and timing of landscape-changing increments at the Po Basin-Apennines hinge helps to describe the Late Quaternary tectonic modulation of landscape response to glacial cycles.

The study integrates different-scale geological, sedimentological, stratigraphic, geo-pedological, geomorphological and structural field surveys constrained by $C^{14}$ and OSL age determinations, and subsurface reconstructions obtained from borehole logs and geophysical images. Focus is on the culminations of Apennine ramp-folds, the San Colombano (SC hereafter) and Casale-Zorlesco (CZ) isolated reliefs, which elevate above the terrace orders of the latest Pleistocene-Holocene plain. These selected key-sectors expose unconformities, morphological surfaces and stratigraphic units otherwise buried in the adjacent plain sectors, and show the involvement of Quaternary, alpine-sourced littoral, alluvial and glacio-fluvial succession in Apennine folding and faulting.

Evidences of syndepositional tectonics are the location of unconformable stratigraphic vs. conformable morphological boundaries, pinch-out and cross-cut relationships among glacio-fluvial and alluvial sedimentary bodies, uplifted paleovalley fills, cannibalism of pre-existing alluvial clastics, colluvial wedges and soft-sediment deformation structures. During Early-Middle Pleistocene, the SC-CZ ramp anticlines underwent thrusting, which uplifted and folded the Gelasian regional unconformity between deep-marine Miocene and littoral Calabrian formations. Late Pleistocene, distal alpine-sourced glacio-fluvial units terraced the deformed marine successions giving origin to the composite Late Pleistocene unconformity. These units, time-constrained by OSL data to MIS6-MIS5, progressively wedge-out and amalgamate S-wards, suggesting confinement by the uplifting ancestors of the present-day hills. MIS4 glacio-fluvial system, fed from the Verbano-Lario glacial amphitheatres, fringed-out above a western uplifted culmination, while a braided glacio-fluvial system flowing South from the central-eastern Lario amphitheatre, terraced the eastern subdued structural highs. Relics of the corresponding planation surface are uplifted at the present-day eastern SC and CZ hilltops. On the uplifted proto-

hills, Late Pleistocene climate cycles are registered by polycyclic loess-soil sequences. Relics of syn-tectonic paleovalley fills, valley diversions, polygonal facets, alignments of windgaps and hanging valleys, suggest that differential uplift and wrenching occurred, plausibly driven by slip along the eastern dextral lateral ramp of the SC structure. The LGM, glacio-fluvial systems prograded S-wards terracing the existing reliefs. Tilting and faulting of these LGM terraces in correspondence of the faceted SC hill fronts, drainage diversions and polyphasic soil reworking at the same sites, imply passive deformation and collapse of the SC structure and hill. Entrenchment and abrupt diversions of the river network which cross-cut the mentioned geological and geomorphological elements, suggest that the Holocene lowermost terraces of the Po Plain formed during concurrent post-glacial increase of fluviatile discharge and tectonic uplift.

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