LANDSCAPE DISSECTION, VETUSOLS DEVELOPMENT, AND ISOSTATIC UPLIFT: THE GEOMORPHOLOGIC RESPONSE OF THE SOUTHERN ALPS AT THE EARLY–MIDDLE PLEISTOCENE TRANSITION

Giancarlo Scardia
INGV, Sezione di Milano-Pavia – scardia@mi.ingv.it

Giovanni Muttoni
Dip. di Scienze della Terra “A. Desio”, Università di Milano

Cesare Ravazzi
CNR, Istituto per la Dinamica dei Processi Ambientali

We examine different geomorphologic evidences observed in the Lombardian Southern Alps (northern Italy) and their foothills during the middle Pleistocene, in order to estimate long-term exhumation rates for early Pleistocene deposits and highlight a common underlying process.
Between the Gelasian and the early–middle Pleistocene transition, tectonic and climatic changes led to the formation of several intermountain basins in the Lombardian Southern Alps. Lacustrine environments mainly developed within these basins under various climatic regimes, bequeathing extraordinary series of traces about the climatic history of the Alps. These basins developed in concomitance of a long-term intravalley aggradation phase that reached its maximum within the Southern Alps valleys around the early–middle Pleistocene transition.
In the characteristic stratigraphy of an intermountain basin (e.g. Bagaggera, Leffe, Val Sabbia basins) a regressive sequence, followed by eolian deposition and strong weathering, can be observed. At the present state of knowledge, if we depict the time span of these lacustrine sequences, we observe an overall extinction of the intermountain basins at the beginnings of the middle Pleistocene, apart from those sites which experienced subsidence by local active tectonics. At the foothills of the Southern Alps, roughly starting at the same time, the oldest fluvioglacial deposits
experienced a long term incision phase, which isolated broad areas of the piedmont Po Plain. On these terraces only eolian sedimentation occurred and vetusols (“feretto” Auct.) started developing.

At the whole, during the Pleistocene the examined area experienced an early Pleistocene aggradation phase, followed by a middle Pleistocene incision phase, that exhumed by erosion the early Pleistocene deposits.

As the major Pleistocene glaciations occurred only in few of the considered basins, the observed long-term change cannot be interpreted as a direct response of river drainages to glaciation. We suggest instead that all these geologic features can be ascribed to an unique process, i.e. the middle Pleistocene long-term uplift identified by means of subsurface geology studies in the Po Plain. This regional uplift is an isostatic rebalance produced by the long-term sum of the erosional effects of repeated glacial-interglacial cycles in the Alps. As response to this isostatic uplift a landscape dissection occurred during middle Pleistocene both in the Alpine chain as well as at its foothills, hampering the formation of new intermountain basins (lowering of the morphologic thresholds) also in not-formerly glaciated areas (Leffe, Ranica, Val Sabbia basins; Orobie and Brescian Prealps), and triggering vetusols development in broad areas of the piedmont Po Plain (long-term geostasy conditions).

Absolute estimates of the observed uplift are not feasible in the examined area (mountain belt) as altimetric constraints were not recognised. Anyway is possible to produce a tentative estimate of the exhumation rates (i.e. the displacement of a point toward to the surface), by taking into account the age and present elevation of the paleosurfaces with the observed vetusols and the present elevation of the cutting river bed.