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COVER IMAGE

The Pontifical Basilica of Saint Nicholas (Bari).

Multi-scale landscape evolution of Central Alps: another side of the Valchiavenna CARG project

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The CARG project of geological mapping near Chiavenna (sheets 021 "Passo dello Spluga", 022 "Madesimo", 037 "Bodengo", 038 "Chiavenna") investigate an area with a complicated topography, resulting from pre-Quaternary Alpine tectonics and Quaternary evolution. The study area is in the Italian Central Alps and is composed of pre-Alpine basement rocks intruded by Permian and Oligocene granitoids, and of Permo-Mesozoic metasediments of the Penninic and Austroalpine domains characterized by a complex deformation history (Steck et al., 2013). The metasediments include quartzite, calc-schists, marbles, and occasionally ophiolites. To the south, these tectonic units are separated from the Southern Alps by the EW dextral strike-slip Insubric Line; to the north, they are separated from the European foreland by the Penninic Front, a SW-NE oriented thrust. Other important structures are the Forcola Line, a NW-SE normal fault located at the eastern border of the Lepontine dome, and the Engadine Line, a NE-SW sinistral strike-slip fault located between the Engadine Valley and the Bregaglia Valley (Ciancaleoni, 2005). Quaternary glaciations heavily influenced the topographic evolution of the area, while gravitative processes continuously shaped the valley flanks. The aim of this work is to define the controlling factors on landscape evolution through a combination of field survey and morphometric analysis. Field survey permitted to collect lithological, structural, and geomorphological data at various scale and highlighted the interplay between several factors (e.g. lithological and structural properties, gravitational, fluvial glacial, and karst processes). Morphometric analysis helps in quantifying the evolution of topography and channel network development through various indices, calculated from a DEM ALOS with a 30m resolution, such as the χ-mapping (the calculation is based on the comparison of two channels originating at the same position x and terminating at the same base level xb, A(x) is the drainage area upstream of x, while A0 is a reference area and m/n is the concavity; the χ-mapping highlights drainage migration direction) and the knickpoint detection (a geometric approach based on the comparison of the actual flow profile against an ideal one; knickpoint detection allows to identifies breaks in slope; Diercks et al., 2021). The interpretation of such indices suggests that regional scale-drainage divides migrate northward. This could be tuned by several processes, namely the gravitational ones. At the local scale of the Val San Giacomo and Val Bregaglia valleys the development of the rivers' pattern is primarily controlled by changes in lithology and structures, as evidenced by differences in knickpoints. Applying morphometric analysis validates the methods and supports the data collected during fieldwork, enhancing the interpretation of the role of the main controlling factors on landscape evolution in this portion of the Central Alps.

Ciancaleoni L. (2005) - Deformation processes during the last stages of the continental collision: The brittle-ductile fault systems in the Bergell and Insubric areas (Eastern Central Alps, Switzerland-Italy) (Doctoral dissertation).

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