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Assessing sediment budgets and short-term erosion rates: petrography, heavy minerals, geochemistry, geochronology and density of modern Dora Baltea sands

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Quantifying sources of river sediments allows us to reconstruct the distribution and magnitude of erosional processes over wide areas, and to assess the potential occurrence of focused erosional processes (Garzanti et al., 2007). Where the properties of source rocks are faithfully mirrored in first-cycle modern sediments, their compositions can be effectively used to assess sediment provenance and relative contributions to the sediment budget.

Beside the long established use of bulk petrography, heavy mineral and detrital geochronology analyses (Weltje and von Eynatten, 2004; Mange and Wright, 2007), geochemistry and even bulk density can represent complementary tools to trace sediment provenance, provided that end members are sufficiently distinct. Integrating different techniques allows us to increase the number of compositional parameters that help us discriminate among diverse end members and thus to perform forward-mixing models with enhanced resolution and more robust assessment of erosion patterns.

In this study we illustrate the integrated use of multitechnique compositional analyses to constrain the short-term erosion pattern in the Western Alps. A complete dataset of the detrital signatures of various tectono-metamorphic units (Garzanti et al., 2010) is used to reconstruct and quantify their contribution to the sediment load of the Dora Baltea River. Data from different techniques were used to cross validate our results and to obtain an integrated overview of the present-day erosion pattern.

Our calculations consistently indicate focused erosion of the Mont Blanc External Massif relative to the axial sector of the belt (Resentini and Malusà, submitted). Such a distribution compares well with long-term exhumation rates constrained by fission tracks analyses and, in the lack of significant correlation with morphological and climatic parameters, supports major tectonic control over short-term erosion in the Western Alps.

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