Detrital fingerprints of fossil continental subduction zones

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The Alps are characterized by two sub-parallel axial belts of Late Cretaceous (Thöni and Jagoutz, 1993) and Eocene age (Rubatto et al., 1998) representing the fossil continental subduction zone between Europe and Adria plates. They include both felsic crustal and ultramafic mantle eclogites. The axial belt units invariably underwent either attempted subduction to subcrustal levels (e.g. Saualpe, Dora Maira, Zermatt-Saas), or were detached and subcreted at intermediate crustal levels (e.g. Schistes Lustrés, Bündnerschiefer), or were offscraped and accreted at shallow structural level (e.g. San Remo and Rheno-Danubian flysches). High pressure parageneses are the distinctive features of such fossil continental subduction zones, yielding their characteristic detrital fingerprints also to the sedimentary record. Analyzing modern river sands from the Alps, we can refine classical "orogenic provenance" models (e.g. Dickinson and Suckzec 1979), providing new tools to unravel information stored in fossil clastic successions.

Metasedimentary cover nappes shed lithic to quartzolithic detritus, including metapelite, metapsammite, and metacarbonate grains of low to medium rank, together with strongly depleted heavy mineral assemblages. Continental-basement nappes shed hornblende-rich quartzofeldspathic detritus. Largely retrogressed blueschist to eclogite-facies metaophiolites supply albite, metabasite and foliated antigorite-serpentinite grains, along with abundant heavy minerals (epidote, zoisite, clinozoisite, lawsonite, actinolitic to barroisitic amphiboles, glaucophane, omphacitic clinopyroxene). Increasing metamorphic grade and deeper tectonostratigraphic level of source rocks are reflected by: a) increasing rank of metamorphic rock fragments (as indicated by progressive development of schistosity and growth of micas and other index minerals; MI index of Garzanti and Vezzoli 2003); b) increasing feldspars; c) increasing heavy-mineral concentration (HMC index); d) increasing hornblende, changing progressively in colour from blue/green to green/brown (HCI index); e) successive appearance of chloritoid, staurolite, kyanite, fibrolitic and prismatic sillimanite (MMI index; Garzanti and Andò 2007).

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