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Axial Belt Provenance: modern river sands from the core of collision orogens

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Collision orogens have a complex structure, including diverse rock units assembled in various ways by geodynamic processes. Consequently, orogenic detritus embraces a varied range of signatures, and unravelling provenance of clastic wedges accumulated in adjacent foreland basins, foredeeps, or remnant-ocean basins is an arduous task. Dickinson and Suczek (1979) and Dickinson (1985) recognized the intrinsically composite nature of orogenic detritus, but did not attempt to establish clear conceptual and operational distinctions within their broad "Recycled Orogenic Provenance".

In the Alpine and Himalayan belts, the bulk of the detritus is produced by focused erosion of the central backbone of the orogen, characterized by high topography and exhumation rates (Garzanti et al., 2004; Najman, 2006). Detritus derived from such axial nappe pile, including slivers of thinned continental-margin lithosphere metamorphosed at depth during early collisional stages, has diagnostic general features, which allows us to define an "Axial Belt Provenance" (Garzanti et al., 2007). In detail, "Axial Belt" detrital signatures are influenced by metamorphic grade of source rocks and relative abundance of continental versus oceanic protoliths, typifying distinct subprovenances.

Metasedimentary cover nappes shed lithic to quartzolithic detritus, including metapelite, metapsammite, and metacarbonate grains of various ranks; only amphibolite-facies metasediments supply abundant heavy minerals (e.g., almandine garnet, staurolite, kyanite, sillimanite, diopsidic clinopyroxene). 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 color 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).

Dickinson W.R. 1985. Interpreting provenance relations from detrital modes of sandstones. In: Zuffa G.G. (ed.), Reidel, NATO ASI Series 148: 333-361.

Dickinson W.R. and C.A. Suczek. 1979. Plate tectonics and sandstone composition. Am. Assoc. Pet. Geol. Bull. 63: 2164-2172.

Garzanti E. and S. Andò. 2007, Plate tectonics and heavy-mineral suites of modern sands. In: Mange M. and D. Wright (eds.), Elsevier, Developments in Sedimentology Series 58: 741-763.

Garzanti E. and G. Vezzoli. 2003. A classification of metamorphic grains in sands based on their composition and grade. J. Sedimentary Res. 73: 830-837.

Garzanti E., C. Doglioni, G. Vezzoli and S. Andò. 2007. Orogenic Belts and Orogenic Sediment Provenances. J. Geology 115: 315-334.

Garzanti E., G. Vezzoli, S. Andó, C. France-Lanord, S.K. Singh and G. Foster. 2004. Sediment composition and focused erosion in collision orogens: the Brahmaputra case. Earth Planet. Sci. Lett. 220: 157-174.

Najman Y. 2006. The detrital record of orogenesis: a review of approaches and techniques used in the Himalayan sedimentary basins. Earth Sci. Rev. 74: 1-72.