



Recycling of quartz-poor/lithic-rich foreland-basin sediments in arid climate (Euphrates-Tigris-Karun river system)

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In this detailed petrological analysis of a large source-to-sink sediment-routing system (catchment area > 1 million km²) we document its several peculiarities, and illustrate a rich petrographic and heavy-mineral dataset integrated by bulk-sediment geochemistry and detrital-zircon U-Pb geochronological data that widens the spectrum of compositions generally assumed as paradigmatic for orogenic settings. We test traditional versus upgraded sedimentary-petrology models in the endeavor to derive a more refined conceptual model of reference, in order to enhance the power of provenance analysis but also to define its limitations and understand which secret of nature is likely to remain beyond reach in our efforts to reconstruct orogenic landscapes of the past.

Sands derived from the Zagros-Southeast Anatolian fold-thrust belt contain an abundance of lithic grains derived not only first-cycle from carbonates, cherts, mudrocks, arc volcanics, and obducted mantle serpentinites representing the exposed shallow structural level of the orogen, but also recycled from Neogene molassic strata exposed in the foothills. Quartz, K-feldspar and mica are equally scarce in first-cycle and recycled sediments. This quartz-poor petrographic signature, characterizing the broad undissected tectonic domain of the Anatolia-Iranian plateau, is markedly distinct from that of sands shed by highly elevated and dissected collision orogens of the same mountain system such as the Himalaya or the Alps. Arid climate in the region allows full preservation of chemically unstable grains including carbonate and mafic/ultramafic rock fragments even through more than a single sedimentary cycle. Also, it reduces transport capacity of fluvial systems, which dump most of their load in Mesopotamian marshlands upstream of the Arabian/Persian Gulf allochemical carbonate factory. Quartz-poor orogenic sediments from the Zagros-Southeast Anatolian range mix with quartz-rich recycled sands ultimately derived from Arabia all along the western side of the foreland basin, and are traced along the Gulf shores as far as the northeastern edge of the Rub' al-Khali sand sea ca. 4000 km from the Euphrates headwaters.