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Invited review

The Euphrates-Tigris-Karun river system: Provenance, recycling and dispersal of quartz-poor foreland-basin sediments in arid climate



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ABSTRACT

We present a detailed sediment-provenance study on the modern Euphrates-Tigris-Karun fluvial system and Mesopotamian foreland basin, one of the cradles of humanity. Our rich petrographic and heavy-mineral dataset, integrated by sand geochemistry and U–Pb age spectra of detrital zircons, highlights the several peculiarities of this large source-to-sink sediment-routing system and widens the spectrum of compositions generally assumed as paradigmatic for orogenic settings. Comparison of classical static versus upgraded dynamic petrologic models enhances the power of provenance analysis, and allows us to derive a more refined conceptual model of reference and to verify the limitations of the approach.

Sand derived from the Anatolia-Zagros orogen contains abundant lithic grains eroded from carbonates, cherts, mudrocks, arc volcanics, obducted ophiolites and ophiolitic mélanges representing the exposed shallow structural level of the orogen, with relative scarcity of quartz, K-feldspar and mica. This quartz-poor petrographic signature, characterizing the undissected composite tectonic domain of the entire Anatolia-Iranian plateau, is markedly distinct from that of sand shed by more elevated and faster-eroding collision orogens such as the Himalaya. Arid climate in the region allows preservation of chemically unstable grains including carbonate rock fragments and locally even gypsum, and 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 sediment from the Anatolia-Zagros orogen mixes with quartz-rich recycled sands from Arabia along the western side of the foreland basin, and is traced all along the Gulf shores as far as the Rub' al-Khali sand sea up to 4000 km from Euphrates headwaters.

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