Petrology and geochemistry of the Miocene-Pliocene fluvial succession, Katawaz Basin, Western Pakistan: Implications on provenance and source area weathering

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Abstract

Petrology and geochemistry of sandstones and mudstones of the Miocene Dasht Murgha Group (DMG) and Pliocene Malthanai Formation (MF) of the Pishin Belt (Katawaz Basin), north-western Pakistan have been carried out to find out their provenance and source area weathering. Sandstones of the Dasht Murgha Group and Malthanai Formation are lithic to sublith- arenites, rich in quartz, and metamorphic and sedimentary lithic fragments, indicating a recycled orogenic source. LmLvLsplots show that the Dasht Murgha Group is rich in sedimentary and metamorphic lithic fragments (Lm35Lv18Ls47), while samples of the Malthanai Formation are overwhelmingly rich in sedimentary fragments (Lm14Lv10Ls76). Eocene Nisai Formation and Oligocene Khojak Formation within the Pishin Belt were mainly providing the sedimentary/metasedimentary detritus. High content of monocrystalline quartz (DMG: 28.21%; MF: 30.7), and higher SiO2/Al2O3 ratios in sandstones (DMG: 9.86; MF: 11.98) also indicate high maturity of sandstones due to recycling of source terrain in collision orogens. High Cr/Ni (DMG: 5.23; MF: 6.17) and moderate Cr/V (DMG: 3.96; MF: 3.88) ratios suggest significant contributions from mafic and ultramafic detritus derived from Muslim Bagh-Zhob Ophiolite. Malthanai Formation has higher CIA and CIW values (68.96 and 77.53) than Dasht Murgha Group (63.87 & 70.93); however, they both indicate low to moderate weathering intensities. Dasht Murgha group and Malthanai Formation have higher ICV values which indicate abundance of aluminous silicates, hence, showing moderate weathering of the source area. In A-CN-K diagrams the samples make linear trend towards illite which suggests that the sediments were derived from a tectonically active source going through non-steady-state weathering, where the detritus has been derived from different zones of weathering profiles.