

Provenance and weathering of siliciclastic rocks in the Tarfaya Atlantic Coastal Basin, SW Morocco

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Lower Cretaceous to Miocene-Pliocene siliciclastic rocks including recent sediments of the Tarfaya Atlantic basin, SW Morocco have been sampled for petrographical, geochemical and isotopical analyses in order to reveal their provenance and weathering history. Compositional and geochemical data suggest that these rocks were derived from heterogeneous sources in the Western Anti Atlas and the Northern Mauritanides, likely forming the basement in this area. The Miocene-Pliocene sandstones as well as the recent sands from Wadis and dunes are generally carbonate-rich feldspathic or lithic arenites while lower Cretaceous sandstones are subarkosic in composition. Their major element geochemistry supports these findings. In addition, it classifies black shales and sandy marls as shale or lithic arenites by $\text{Log}(\text{SiO}_2/\text{Al}_2\text{O}_3)$ and $\text{Log}(\text{Fe}_2\text{O}_3/\text{K}_2\text{O})$ ratios. The siliciclastics are characterised by moderate SiO_2 contents and variable abundances of Al_2O_3 , K_2O , Na_2O and ferromagnesian elements. Chemical weathering in the source area, expressed as chemical index of weathering, was high during the lower Cretaceous and low to moderate from upper Cretaceous to recent time. The SiO_2 - $\text{K}_2\text{O}/\text{Na}_2\text{O}$ discrimination diagram and immobile trace elements, such as Zr, Th, Sc, La, show that most samples can be characterized tectonically as passive continental margin. The minor element ratios, La/Sc, Th/Sc, La/Co, Th/Co, Cr/Th, are typical for felsic source rocks. Chondrite-normalized REE patterns with LREE enrichment, flat HREE, and negative Eu anomaly are indicating felsic source rocks.

The similar Sm/Nd ratios for all analyzed siliciclastics and the identical isotopic values of black shales, mudstones, sandstones and recent sediments indicate that no significant fractionation of Sm and Nd occurs during formation of the siliciclastics. Thus, the Nd model ages of the sediments preserve the crust formation age of the source. Low $^{143}\text{Nd}/^{144}\text{Nd}$ and high $^{87}\text{Sr}/^{86}\text{Sr}$ ($\epsilon\text{Nd} = -10.6$ - -25.5 ; $^{87}\text{Sr}/^{86}\text{Sr} = 0.714$ - 0.846) indicate predominance of old upper crustal sources. Nd model ages suggest that during lower Cretaceous time the sediments derived from the West African craton exclusively, since the upper Cretaceous, sediments originate from the West African craton as well as the Western Anti Atlas.

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