Geochemistry of Beach Sands from Three Different Sedimentary Environments of Mexico

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In this work, major, trace, and rare-earth element geochemistry of 100 sand samples from different beaches of Mexico were studied to determine the provenance characteristics. The sand samples studied are from Gulf of Mexico (Cazones, Tecolutla and Nautla), Pacific Ocean (Acapulco), and Gulf of California (Bahia kino) beaches. Most of the sand samples are classified as felsic sands using $(SiO_2)_{adj}$ content. The variations in SiO_2, Fe_2O_3, MgO, TiO_2 contents and Al_2O_3/TiO_2, K_2O/Na_2O, SiO_2/Al_2O_3 ratios among the study areas reflect differences in source rock characteristics. The low Chemical Index of Alteration values (CIA = ~ 60) suggest the prevalence of week weathering conditions in the source regions. A steady weathering trend identified in the A-CN-K diagram for Acapulco (Pacific Ocean) and Cazones (Gulf of Mexico) sands is indicative of uplift along the source region and represent that sands were derived from diverse sources. The differences in Zr and Hf contents with respect to the study areas indicate the addition of heavy mineral zircon during hydraulic sorting. Similarly, the higher abundances of TiO_2, Ta, Nb, and Nd contents are consistent with the observed presence of Ti-bearing mineral ilmenite in some sand samples. Wide variation in ΣREE content among the study areas is likely due to the differences in fractionation of minerals as well as the source rocks. The comparison of REE data with the source rocks located relatively close to the study areas suggest that the sands of Gulf of Mexico (Cazones, Tecolutla and Nautla) and Pacific Ocean (Acapulco) were derived by the contribution of felsic and intermediate rocks, whereas the Gulf of California (Bahía Kino) sands were derived from felsic rocks. Also, this study suggests that REE patterns and Eu anomalies are well preserved in the beach sands and are highly reliable indicator of source rocks, even though the geochemical composition can be affected by processes such as hydraulic sorting during transportation.