



Sedimentological, Mineralogical and Geochemical Characterization of Sand Dunes in Saudi Arabia

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Sedimentological, mineralogical, morphological and geochemical studies of sand dunes from ten locations in Saudi Arabia were conducted in order to determine the differences between them and to find out the provenance and tectonic setting of these sand dunes. Sixty seven samples were collected from different sand dunes types ranging in morphology from linear, barchans, parabolic to stars dunes. In overall, the sand dunes are fine to coarse grained mean grain size, moderately sorted, near symmetrical skewness with mesokurtic distribution characterized sand dunes in most locations. The sand dunes grains are subrounded in all locations except in the Red sea, Qassim, central Arabia and the eastern province which showed sub-angular grains. The main mineral compositions of studied aeolian sand dunes are quartz, feldspar, calcite, and mica. Quartz is the dominant mineral in locations with significant amount of feldspars and mica in Najran, Red sea and Central Arabia locations. Moreover, calcite is present in Sakaka and NW Empty Quarter (Jafurah). Basement related sand dunes in Najran, Central Arabia and Red sea locations are sub-mature in terms of their mineralogical maturity. Whereas, sand dunes in other locations are texturally mature except those from the Red sea which showed sub-mature sand. The sands are classified as quartz arenite, except in the basement related sand dunes in Najran, central Arabia and the Red sea are ranging from sub-arkose, sub-litharenite and lithraenite. Morphologically, parallel to sub-parallel sand ridges with NE-SW orientation occurred in east and north parts of Empty Quarter (Najran and Jafurah) and NW-SE orientation in Dahna and Nafud deserts in central and north regions of Saudi Arabia. Parabolic sand dunes characterized the Nafud desert (Hail, Sakaka, Tayma locations). Barchans and star sand dunes characterize the Empty Quarter (Jafurah). Major, trace, and rare earth elements studies were carried out to determine the composition, provenance and tectonic history of the sand dunes. Geochemical analysis indicated that most of sand dunes are quartz arenite type, except in the Red sea, basement related central Saudi Arabia and Najran areas, the sand dunes are sub-arkoses, sub-litharenite and litharenite. The concentration of major, trace and rare elements showed active continental margins as a tectonic setting of Red sea, basement related Najran and central Arabia sand dune. In contrast, passive continental margins for the other locations. The distribution of major, trace and rare earth elements showed similarity in chemical composition between basement related sand dunes in Red sea, Najran and central Arabia.