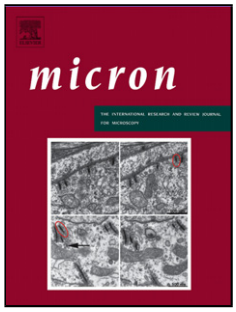

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Spectral method as a tool to examine microtextures of quartz sand-sized grains

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Abstract

Well-rounded grains extracted from aeolian and subaqueous environments were analysed to determine a quantitative parameter describing the microtopographic surface properties of sand-sized quartz grains, expressed as a degree of smoothness or as an inverse roughness. To this end, the spectral method was used to calculate their fractal dimension values. Fractal characteristics and spectral fractal dimension (D_S) were determined for a scanning electron microscope (SEM) image (560 x 560 pixels) obtained for each study grain. This parameter, (D_S), describes the complexity of objects, which means that the higher its value, the more complicated the analysed grains are in terms of exterior roughness and surface microirregularities. The obtained results indicate that values of the parameter (D_S) were higher for all aeolian grains compared to grains from either low- or high-energy subaqueous environments. This difference in results is attributed to the presence of microirregularities on the surface of aeolian grains, microtextures forms such as mechanically upturned. This parameter value increases as the energy of the aeolian environment increases. Values of (D_S) for subaqueous environments grains correlated with the frequency of microtextures that resulted from high-energy grain-to-grain collisions (*e.g.*, V-shaped percussion cracks), or from the chemical etching of the grain surface (*e.g.*, solution pits, solution crevasses)—the higher the frequency of either collision or chemical-etching microtextures, the higher the value of the fractal dimension (D_S). Thus, it has been demonstrated that fractal analysis can serve as a useful tool to discriminate between the analysed sedimentary environments, to assess a depositional system's kinetic energy, and to compare the intensity of chemical weathering.