Allostratigraphic analysis of linear dunes without visible erosional boundaries using cluster analysis of portable OSL signals

Lotem Robins1,2, Joel Roskin3,1, LuPeng Yu4, and Noam Greenbaum2
1Geomorphology and Portable Luminescence Laboratory Leon Recanati Institute for Maritime Studies, U. of Haifa, Abba Hushi Ave., 199, Mt. Carmel, Haifa 3498838, Israel
2Department of Geography and Environmental Studies, University of Haifa, Mount Carmel, Haifa, Israel
3Department of Geography and Environment, Bar Ilan University, Ramat-Gan, Israel
4Luminescence Laboratory, School of Resources and Environmental Sciences, Linyi University, Linyi, China

The internal structure of dunes often lacks clear internal boundaries and complicates allostratigraphic analyses and correlation with adjacent dunes. Furthermore, several dune studies involved hand-drilling, which exclude allostratigraphic analysis. Here, high-resolution sand sampling from two linear dune sections and a hand-drilled linear dune, was performed along the northwestern Negev (Israel) dunefield. The bulk samples were used for allostratigraphic analysis by Portable Optically Stimulated Luminescence (POSL) device. The samples were clustered by a Mean-shift unsupervised cluster analysis, applied on the Infra-Red and Blue counts, previously found to vary according to the time of burial, mineralogy and luminescence properties. OSL ages and particle size distribution were reviewed according to the cluster analysis results.

The POSL cluster analysis can reliably outline dosimetric breakpoints between units along a single stratigraphic section and between adjacent dune sections. The clusters document a distinct depositional period when OSL age ranges match well with the POSL clusters. Textural and mineralogical differences, generated by several mechanisms such as post-depositional processes, dune degradation followed by nearby alluvial sand aggradation, pedogenesis, and shrub root penetration can also account for dosimetric breakpoints and need to be considered.