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Using palynology to re-assess the Dead Sea laminated sediments - Indeed varves?

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Lacustrine laminated sediments are often varves representing annual rhythmic deposition. The Dead Sea high-stand laminated sections consist of mm-scale alternating detrital and authigenic aragonite laminae. Previous studies assumed these laminae were varves; detritus deposition during the winter and aragonite in the summer. These sequences were used for varve counting and chronology, however this assumption has never been robustly validated. Here, we report an examination of the seasonal deposition of detrital and aragonite couplets from two well-known Late Holocene laminated sections at the Ze'elim fan-delta using palynology and grain-size distribution analyses. These analyses are complemented by the study of contemporary flash-flood samples and multivariate statistical analysis. Because transport affects the pollen preservation state, well-preserved (mostly) air-borne transported pollen was analysed separately from badly-preserved pollen and fungal spores, which are more indicative of water transport and reworking from soils. Our results indicate that (i) both detrital and aragonite laminae were deposited during the rainy season; (ii) aragonite laminae have significantly lower reworked pollen and fungal spore concentrations than detrital and flash-flood samples; and (iii) detrital laminae are composed of recycling of local and distal sources, with coarser particles that were initially deposited in the Dead Sea watershed and later transported via run-off to the lake.
The conclusions suggest that detrital and aragonite couplets in the Dead Sea laminated sediments are most likely not varves and that the laminae deposition is related to the occurrence of flash-flood events. Consequently, at least for the Holocene sequences, laminated sediments cannot be considered as varves and Quaternary laminated sequences should be re-evaluated. The Dead Sea Basin laminated sequences (as the ICDP Dead Sea Deep Drilling Project record) should be used for the reconstruction of palaeo-flash flood records that will have a significant impact on understanding the palaeo-hydrology of the DSB and its implication to high-resolution climatic interpretation.