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Sinkhole swarms along the Dead Sea coast

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Over the past several years the coastal area around the declining Dead Sea has undergone a catastrophic collapse. One of the major expressions of this process is the sudden appearance of hundreds of collapse-sinkholes, causing a severe threat to the future of this region. The results were obtained from a multi-disciplinary research conducted since 1999. Observations were obtained by geological mapping, aerial photographs, drilling, groundwater geochemistry, seismic refraction and reflection, and satellite radar interferometry. The suggested model for the formation of the Dead Sea sinkholes is based on the following observations: (1) presence of a thick salt layer (or layers) at depths between 20 and 50 m (depth of layer top), and sandwiched between aquiclude layers of clay and silt, (2) identification of cavities within the salt layer in sinkhole sites, (3) presence of water undersaturated with respect to halite in aquifers confined beneath the salt layer, (4) the composition of the groundwater in the salt layer which indicates salt dissolution, (5) association between sinkhole sites and land subsidence, and (6) formation of sinkholes along and above buried faults. These observations combine to suggest that the primary cause of sinkhole formation is dissolution of the salt layer by undersaturated groundwater. The interface between the Dead Sea brine and this groundwater migrated eastward due to the Dead Sea decline. Undersaturated water accessed the salt layer via faults that cut through the soft aquiclude layers. Opening of these conduit-faults is likely due to differential compaction of the aquiclude layers, explaining the correlation between the land subsidence and sinkhole sites. It appears that the decline of the Dead Sea level affects the formation of sinkholes in three ways, 1) opening the way to eastward migration of the fresh-saline interface and thus to undersaturated groundwater, 2) generating differential compaction of fine-grained sediments, and 3) destabilization of underground cavities which catalyzes their collapse.