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Sand on salt: Controls on dune subsidence and determining salt substrate thickness

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Salt bodies are notoriously difficult to image using seismic reflection data. Linear dunes in the Norphlet sandstone in the Gulf of Mexico were developed on the underlying Louann salt layer during the Late Jurassic as they subsided into the salt substrate. Due to imaging difficulties, the thickness of the salt is variable and largely unknown. We performed physical experiments and created a mathematical model to understand dune and salt deformation and to determine the controls on the final preserved dune topography. Our results indicate that the ratio of sand to salt thickness governs the amount and rate of subsidence in natural systems, thus affecting the final dune relief. However, given a narrow basin, as in our experimental system, dune width (i.e. dune spacing) has a larger control on subsidence patterns. We conclude that preserved dunes with high relief indicate areas of relatively thin salt thickness and/or close dune spacing, and that dunes with low relief indicate areas of relatively thick salt thickness and/or wide dune spacing. Seismic data from the Gulf of Mexico corroborates our results.

Keywords: salt, dune, subsidence