Seismic attribute expression of differential compaction

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Abstract

In a marine environment, topographic features on the sea floor will usually be covered by a thick layer of shale with the rise of sea level, resulting in a uniform, nearly flat surface. Evaporating seas may bury sea floor topography with a thick layer of salt. In a fluvial-deltaic environment, channels are cut and filled with a lithology that may be different from that through which it is cut, followed by subsequent burial with (perhaps) a more uniform sedimentary layer, With continued burial and overburden, pore sizes are reduced and water is squeezed out of the rocks, reducing the rock volume. Different lithologies have different original porosity, pore shapes, and mineral matrix composition, and thus different response to burial. Lateral changes in lithology give rise to lateral changes in compaction, or simply "differential compaction". For this reason, easily-mapped flooding and other surfaces that were originally flat can exhibit measureable, and often significant structural relief. These maps give rise to lateral "structural" anomalies. Recognition of differential compaction forms a key component in modern seismic geomorphology based interpretation workflows with excellent publications showing the expression of differential compaction on vertical slices. Mapping the 3D expression of compaction features takes considerable time and is thus less well reported and the use of 3D geometric attributes to map compaction features is underutilized. In this paper we illustrate the attribute expression of the more common differential compaction features over channels and carbonate reefs using examples from the Western Canadian Sedimentary Basin.