Evidence of Differential Salt Spine Movement at Weeks Island Salt Dome, Iberia Parish, Louisiana

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ABSTRACT

An improved understanding of the tectonic behavior of salt can be obtained when microstructural and fabric data from the salt are used in conjunction with other geologic information including mapping of the flank sediments surrounding the salt. Weeks Island is an active Gulf Coast salt diapir as indicated by the topographic relief associated with the salt stock and mapping the shallow geology. Sedimentation around shallow salt structures is often influenced by contemporaneous faulting and episodes of near surface salt movement. Isopach/isochore mapping can be used to analyze the interaction of the salt mass with the surrounding sediments, giving important clues about the growth history of the salt structure. A series of isopach/isochore maps constructed for the shallow flank sediments down to the middle-Miocene "Tex W" indicates that the Weeks Island salt diapir has grown episodically during approximately the last 11.5 million years as two major salt spine complexes.

The internal fabric (texture, structure, preferred grain orientation, grain size, etc.) and microstructure (subgrain network) observed in salt samples from salt mines and salt core can provide important clues on the deformational history of a salt structure including recently or currently active geologic processes that can impact salt cavern operations. Limited data presented by Pfeifle et.al. (1994) for Gulf Coast salt domes indicated that subgrain size was a good indicator of strength and deformational properties of domal salt.

Subgrain formation dominates microstructural development during steady-state flow of salt and it has been shown by Carter, et al. (1993) that subgrain diameter is inversely proportional to stress alone where

$$D_{(\mu m)} = 214\ \sigma^{-1.15}\ (MPa)$$

Estimated differential stress levels recorded by subgrain size in the salt at Weeks Island vary from 0.87 to 2.33 MPa. Comparison of the microstructure data with other geologic information indicates that geologic significance can be attached to this variation in stress. At Weeks Island, the more actively moving salt is indicated by higher stress levels and smaller subgrains, which are generally associated with higher surface topographic relief and in the case of Weeks Island, fluid-rich, coarse-grained, recrystallized salt.

These techniques can be used for other salt domes to help identify boundary shear zones, areas of active salt movement, and other geologic phenomena that can prove troublesome for salt mine and cavern storage operators over the operational life of a project.

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