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Geopressure and Seismic Estimation of Enhanced Reservoir Quality—Subsalt Analogs

Abstract

Seismic data are now used quite often to detect abnormal subsurface pressure. Findings are then employed to design casing and mud-weight programs that facilitate drilling. It is also known that the long-term presence of geopressure can cause changes in rocks that affect their properties as well as those of the core fluids. Research is progressing in this area involving principally geochemistry and well logs.

It is also recognized that reservoirs beneath salt can represent favorable circumstances but also present formidable problems with seismic imaging. Here we note the possibility of analogously favorable reservoirs, but now associated with geopressure further favors having the possibility of seismic detection in advance of the drill.

First, a pressured reaction (especially shale) can constitute a formidable barrier to hydrocarbon leakage much as the case with overlying salt. Next, just as salt having high thermal conductivity more efficiently cools a section below, so thermal eddy currents could produce a similar effect. One obvious consequence of cooling is to slow down processes that destroy porosity and permeability and also affect hydrocarbon maturation which forms oil and ultimately cooks it to carbon.

Lastly, the force driving the upward movement of salt layer bedded from a redirection of the overburden forces squeezing down on the mobile salt. "Squeezing" water from an overpressured zone or leakage may cause similar compaction shielding, also possibly enhancing reservoir quality. Because the case of enhancement associated with geopressure is usually more amenable to seismic imaging, detection and assessment can be accomplished more readily than in the case of sub-salt, particularly if some well

control or prior information is available. A case study from offshore Texas predicting and validating such enhancement is discussed.

Biographical Sketch

DR. NORMAN S. NEIDELL received a BS in mathematics from New York University, a postgraduate degree in applied geophysics from Imperial College, and a PhD in geodesy and geophysics from Cambridge University. He acquired basic experience with Gulf Oil and Seiscom-Delta, and then undertook independent ventures and consulting in 1971. His special interests include seismic stratigraphy, reservoir definition, and imaging technology.



Dr. Neidell co-founded Geoquest International and Geoquest System (a Schlumberger company) and Zenith Exploration Co. serving as its President and Chief Executive Officer. He also co-founded Gandalf Explorers Intl. Ltd, which later became MMS Petroleum PLC and ultimately Ramco Energy in 1998. He formed a new company, Wavefield Image, to exploit his interests in new methods of high-resolution seismic imaging. Wavefield Image merged with Zydeco Energy, an offshore exploration company. Dr. Neidell resumed his consulting practice in 1999.

He was Adjunct Professor in the geology department at the University of Houston. Dr. Neidell is a Past President and Honorary Member of the Geophysical Society of Houston (GSH), a Distinguished Lecturer for the SEG and an Honorary Life Member, a Past Associate Editor of *Geophysics*, and a member of several AAPG and SEG committees. He lectures in continuing education programs for the AAPG, SEG, and SPE as well as several universities. ■