

Wednesday, February 28, 2018

Petroleum Club of Houston • 1201 Louisiana (Total Building)
Social Hour 11:15 a.m.
Luncheon 11:45 a.m.

Cost: \$35 Preregistered members; \$40 non-members/walk-ups

To guarantee a seat, pre-register on the HGS website & pre-pay by credit card.

Pre-registration without payment will not be accepted.

Walk-ups may pay at the door if extra seats are available.

If you are an Active or Associate Member who is unemployed and would like to attend this meeting, please call the HGS office for a discounted registration cost. We are also seeking members to volunteer at the registration desk for this and other events.

HGS General Luncheon Meeting

John Karlo

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Your Next Dry Hole Will Most Likely Be Caused By Seal Failure

Owing to advances in seismic technology two of the major components in conventional prospects, trap geometry and reservoir presence, can be so fully evaluated that these components often carry minimal exploration risk. As a consequence the primary cause for dry holes and sub-economic discoveries has now shifted to being the result of seal failure. A survey done by Schlumberger proposes that 45% of industry dry holes are owing to lack of seal. A recent paper by Rudolph and Goulding (2017) supports idea. A post mortem study of exploration drilling by Exxon over a ten year period found that 50% of the dry holes resulted from trap failure and this percentage increased to 60% in mature or well understood plays. Despite these findings there is a lack of understanding regarding importance of seals in hydrocarbon trapping and the sophistication of seal evaluation. In most work flows seal evaluation is commonly done with little technical rigor during the time squeeze at the end of a prospect evaluation and the seal evaluation is often so superficial as to be nearly meaningless.

Part of the reason for a lack of rigor is complacency, a misplaced attitude of – *I have a thick shale so how can there be seal risk?* But beyond this there are systemic factors that confuse, misdirect and frustrate non-specialist's efforts. First, there is no consensus among practitioners about sealing mechanisms and how to evaluate them – i.e. there is no accepted seal evaluation workflow. During the 2012 EAGE conference on seals a poll was conducted and on nearly every question sizable minorities disagreed with the majority views. For example, on the question whether fault gouge acts as a static seal, 59% of respondents said it often did and 27% said it did not. Second, larger companies have conducted research in this area, but data and conclusions are proprietary and key concepts are under documented in published literature. Those doing evaluations are forced to extrapolate globally from a very limited number of local studies. It is common to have a major concept based on a single published study. A cynic, with justification, may see the foundations of seal evaluation as so weak that the whole effort is invalid.

To do better and realistic seal evaluations leading to fewer dry holes, requires three things:

1. A good technical understanding of seal failure mechanisms including misconceptions and evaluation pitfalls. As cases in

point knowing when gas chimneys are positive risk features or why blown traps in the North Sea are still often drilled as discoveries.

2. A Play Based Exploration approach that fundamentally asks “What do you know and where do you know it?” Doing play focused lookbacks that establish baseline statistics on seal failure and comparison of your prospect's seal to both known successes and failures in terms of facies, seismic character, physical properties, etc. As an example, typical deepwater shales in Brazil retain less than half the hydrocarbon column of typical deepwater shale seals in the Gulf of Mexico.
3. A coherent risking philosophy that weighs both confidence in the seal model and the technical conclusions from that model. A philosophy that takes the degree of uncertainty in the seal model as part of the risking input. Quotes from statistician George Box are relevant to this, *All models are wrong but some are useful* and *How wrong do they have to be to not be useful.* ■

Biographical Sketch

John Karlo worked for 30 years with Shell followed by 5 years with Maersk Oil and 2 years with Repsol. He has held positions in play development and prospect evaluation, regional evaluation teams, deep water exploration, mergers and acquisitions. John worked was a senior advisor in Quality Assurance overseeing rigor in structural interpretation for ten years. He has worked in rifts, passive margins, fold belts and turbidites in multiple basins worldwide. Some of the high points in his career include the first regional synthesis of the Dutch North Sea tectonics, groundbreaking work on Gulf of Mexico salt tectonics and deepwater exploration leading to world class discoveries in Nigeria. His current focus is on the complex subject of seal evaluation and the seismic expression of structural styles, subjects where he feels he can contribute to the education of the upcoming generation of geoscientists. Prior to his industry career he taught structure and geophysics at Central Michigan University John received his BA from Rutgers University, MA from Univ. Missouri and a PhD in structure and tectonics from S.U.N.Y.

