



# Houston Geological Society

## ABSTRACT

Applying New Technologies to Old Areas: Relative Geologic Time, Wheeler Diagrams and Near Field Exploration in Faulted Plays

Steve Tobias, Houston Geological Society, North American Dinner -  
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[Youtube conference](#)

Large 3D seismic volumes cost tens of millions of dollars to acquire, millions to process and hundreds of thousands or more to interpret. And yet more often than not, only a small percentage of seismic reflections are mapped out, typically top/base of key reservoirs and seals, flooding surfaces and sequence boundaries. It seems intuitively obvious that a lot of useful information is being left behind, and yet what to do? Picking every horizon would be as de-focusing as it would be time consuming. And anyway, what would it give you?

This presentation explores this intriguing topic by examining an integrated data set offshore Louisiana. Using new technologies, every peak and trough in a 3D volume can now be rapidly converted into thousands of small “mini-maps” which are then weaved into a highly detailed volume by an interpreter. Because these many thousands of surfaces are chronostratigraphic, it becomes possible for the first time to assign a Relative Geologic Time (RGT) to each one of them using quite clever software (several excellent vendors offer RGT capability – here we use Paleoscan by Eliis). This allows the ready transformation of these richly detailed seismic volumes from a form familiar to workstation users (the vertical axis being depth or two-way-time) into something totally unique: a vertical RGT axis. This transformation yields the 21st century version of the venerable Wheeler diagram, but with exquisite 3D detail instead of a cartoon-like representation. This transform should be every bit as important to a seismic interpreter as a Fourier or Wavelet Transform is to a geophysicist. Yet because of its newness, the application of Wheeler Transforms to interpretation methodology is in its infancy.

With the help of: 1) the Wheeler Transform, 2) viewing in different azimuths, 3) integrating and propagating well logs and paleo tops, 4) studying the “instantaneous” accommodation space of each sequence, and 5) the construction of key seismic attributes and animation techniques, the weaved RGT volume can be sectioned into properly defined stratigraphic sequences. Only then can stratigraphic exploration proceed in a systematic way while fully integrating all the 3D seismic data.

What is perhaps just as interesting for teams working the Gulf of Mexico is that this approach provides an important new seismic stratigraphy tool for those exploring in faulted environments. Many must have noticed that the eustatic signatures so helpful to international seismic stratigraphers (such as onlap, downlap, etc.) are mostly missing in and around expansion faults. The reason for this is that the various onlaps terminate against fault planes instead of underlying strata. The eustatic signatures are there, but manifest in a different dimension. Only through the study of expansion profiles can these signatures be recovered and various systems tracts better described. As will be discussed, the study of expansion profiles dovetails quite well with RGT analyses. Another important part of this workflow that will be discussed is the need to initially decouple structural from stratigraphic analysis, and then recouple them again within the geomodel, followed by the propagation of various calibrated properties throughout the model.

Taken together, these new technologies hold the promise to rejuvenate “Near-Field” stratigraphic exploration in old areas.

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*Steve Tobias holds degrees in geology and geophysics and has had a long career in both New Ventures and Near Field Exploration. He started with Mobil, and later worked with Tenneco in Colombia and BHP Petroleum in Australia. He was Pogo Producing’s first international exploration manager during the time that they drilled up the highly prolific Gulf of Thailand. Steve led an international consulting group for seven years, and then co-founded South Bay Resources in 2003. It was extremely successful in using neural networks in the exploration of onshore Texas and Alberta, until it wasn’t. Steve then joined Hess where he served in various roles, including Manager of Exploration Excellence and Denmark Exploration manager for three years. For the past year, Steve has provided exploration services for a variety of clients in the GOM and the North Sea. His current area of focus is offshore Gulf of Mexico on the outer shelf and deep water, with emphasis on subsalt plays. Steve also consults in the use of Paleoscan workflows.*