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Paradigm AAPG 2014 Abstracts: Advanced Science for Everyone

G&G Interpretation

Geologic Correlation and Sectioning: Improving 3D Reservoir Characterization, Development Planning and Well Planning
Presented by David Swales

Correlating markers across wells is one step in a broader geological workflow, and one of the first steps in geological interpretation. Ultimately, a geologist will use correlation to generate structure and net pay maps, based on log cutoffs. From these maps, geologists often make key decisions about where to place their next well during field development. We will take you through an integrated workflow that uses geophysical, geological and petrophysical data to aid in the decision-making process. Real-time marker updates, in addition to gridding techniques relying on markers and petrophysical logs, will demonstrate an integrated approach to performing traditional geologic interpretation.

Supporting Technologies: StratEarth®, SeisEarth®

Well-tie Tomography: A Fast and Efficient Workflow to Update a Velocity Model in Anisotropic Media for Precise Well Placement
Presented by Gaby Yelin

An accurate domain conversion represents a "sine qua non" condition to optimize well placement when seismic data and interpretation data are used for well planning. In the depth domain, seismic interpretation does not always tie well markers, suggesting that the anisotropic characteristics of the media have not been incorporated in the velocity model.

This presentation demonstrates a fast and easy approach to update medium parameters (velocity and anisotropy) for a depth-to-depth correction using the principles and methodology of 3D tomography. Well-tie tomography uses the mistie between seismic interpretation and well markers to update the medium's velocity parameters in a traveltime preserving manner. This technology can be taken as a real time approach to refining velocity and anisotropy based on well marker information as it is collected. This presentation also addresses how well-tie tomography can be used to investigate pitfalls in seismic data interpretation, and evaluate different scenarios.

Supporting Technologies: GeoDepth® Tomography, SeisEarth®

Volume Interpretation Solves the Correlation Challenge: Developing a 3D Stratigraphic Model from Traditional Seismic Interpretation
Presented by Remy Seltz

How much seismic data can I interpret? How much time can I afford to spend interpreting one single seismic volume? How many seismic events do I need to interpret to get the best stratigraphic understanding from my seismic data?

This presentation demonstrates a new perspective on volume interpretation, and provides a unique workflow that includes:

- Semi-automatic fault picking based on fault likelihood attributes generated from a combined use of the semblance, fault dip and azimuth seismic attributes
- Automatic seismic event interpretation combining the Paradigm Seismic Propagator and the SKUA UVT Transform® to quickly build an accurate chronostratigraphic model

The fine scale 3D model can then be used directly for stratigraphic interpretation, reservoir modeling and reservoir characterization. The chrono-stratigraphic model will match all seismic coherent signals, and not only the few horizons typically interpreted, allowing the accurate use of seismic information in stratigraphic interpretation and reservoir modeling.

Supporting Technologies: SKUA® Interpretation Modeling

Unconventionals

Quantitative Seismic Interpretation for Unconventional Plays – An Eagle Ford Shale Play Example
Presented by Joanne Wang

To ensure a successful well in a shale play, we must drill at the target which is favorable in fluid content, in-situ stress and rock properties. Seismic data provides valuable information for different stages of shale play exploration and production. Transforming the seismic data into much-needed reservoir quality information requires the support of a number of technologies and workflows.

This presentation showcases Paradigm Quantitative Seismic Interpretation technologies applied to an Eagle Ford shale formation to identify "sweet spots" which are characterized by the presence of TOC (Total Organic Carbon), shale brittle/ductile quality and in-situ stress.

Supporting Technologies: EarthStudy 360®, Probe®, Vanguard®, SeisEarth®

Understanding Stimulated Rock Volume Geometry Using Microseismic Data
Presented by Hassane Kassouf

Assessing the extent and shape of the rock volume affected by hydraulic fracturing is one of today's greatest challenges in unconventional shale plays. It is often considered to be the key to understanding and estimating production from horizontal wells and optimizing field development. Microseismic events provide valuable information to assess hydraulic fracture propagation and quantify stimulated rock volumes. Through its modeling platform, integrating geophysical, geological and engineering data, Paradigm offers a wide range of options to visualize, analyze and interpret microseismic data and enable the quantitative estimates of stimulated rock volume.

Supporting Technologies: SKUA®

Interactive Well Planning & Geosteering for Sweet Spot Optimization
Presented by Doug Gilmour

The challenge of producing hydrocarbons economically from unconventional resource plays drives the need for well path and engineering design optimization at every stage of the planning and drilling process.

This presentation demonstrates a collaborative petro-technical solution that addresses the needs of both drilling engineers and geoscientists within a comprehensive plan-to-completion workflow that includes detailed constraint-based well planning, for rapid generation of drillable well plans and interactive real-time geosteering. This allows the stratigraphic position of the wellbore to be determined accurately and any required trajectory adjustment to be identified.

Supporting Technologies: SeisEarth®, Geolog® Geosteer®

Geologic Modeling in Fractured and Structurally Deformed Regimes

Advanced Fracture Interpretation and Characterization
Presented by Hassane Kassouf

Accurate fracture interpretation and characterization can be some of the most tedious tasks associated with 3D model building. Yet fracturing also plays a defining role in production, storage and seal characteristics for many play types, including carbonates, basements and shales. In this demonstration, we will explain how fracture density and orientation information derived from a variety of seismic, petrophysical and geomechanical sources may be integrated to generate geologically constrained discrete fracture networks (DFN). Fracture induced permeability; porosity and fracture area per volume are output directly to the reservoir model, from where they can be exported to a reservoir flow simulator. Uncertainty related to the fracture network is reduced by providing an understanding of the fracture permeability and porosity distribution up front, allowing development and production infrastructure to be planned with greater confidence.

Supporting Technologies: SKUA®, SeisEarth®

Integrated Uncertainty Analysis – Impact of Fault Position Uncertainty on Reservoir Assessment
Presented by Emmanuel Gringarten

Accurately determining and positioning faults is of utmost importance in the characterization of oil and gas reservoirs. They often determine the extent of the reservoir and its internal compartmentalization. It is recognized that there is tremendous uncertainty associated with fault interpretation, yet little is done to quantify that uncertainty and even less to propagate it through to 3D modeling and flow simulation. Fault uncertainty affects, among other things, hydrocarbon in-place volumes, well positioning, fault seal calculations, and of course reserves. It is seldom considered during history matching. The main reason is that until now, it was technically tedious to modify a fault model and the associated reservoir grid, once it is created, and still preserve the integrity of the structure. The 3D grids must generally be reconstructed manually, limiting the number of models considered.

A new approach based on SKUA's UVT will be demonstrated. It enables the stochastic simulation of a complete structural model, including multiple horizons and faults, automatically updating the associated geological model. Combined with petrophysical uncertainty, this approach enables us to quantify the impact of structure on reservoir volumes and connectivity, as well as on production forecasts.

Supporting Technologies: SKUA®

Formation Evaluation and Facies Determination

Delineating Facies Heterogeneities and Predicting Lithology Distributions
Presented by Bruno de Ribet

A 3D reservoir property model is fully described by the principle subsurface rock types and their accurate spatial distribution. This presentation significantly expands the traditional uses of pre-stack data for seismic characterization, through the use of classification procedures for predicting lithofacies away from the wellbore and for assessing the uncertainty for each rock type. This innovation enables workflows that capture reservoir heterogeneities and detail normally not feasible in standard reservoir characterization workflows, and allow the geoscientist to build or update a 3D geologic model with quantification of uncertainties. The principles of the method will be illustrated by a carbonate reef case study.

Supporting Technologies: SeisEarth®, Facies prediction

Increase Confidence in Your Reservoir Facies Models: Bring Your Geological Concepts to Life
Presented by Remy Seltz

Facies define the internal architecture of the reservoir. Consequently, their prediction from digital data and emplacement in a geologic model must be handled with precision. Facies not only determine hydrocarbons in-place by defining pay versus non-reservoir rocks and by constraining porosity and fluid distribution, but they also control fluid flow by describing barriers and high permeability streaks. Facies capture the connectivity and tortuosity of the reservoir. For a reservoir model to be predictive, it must be geologically realistic. Facies models are not simply stochastic representations of properties; rather, they must incorporate geological concepts, i.e. the geologist's understanding of the subsurface. The models must also be reliable away from the well data, constrained by both seismic data (if available) and geological constraints. This presentation will demonstrate various methods for deriving 3D facies probabilities by combining wells, seismic and geological concepts. When used in connection with the appropriate geostatistical techniques, they lead to robust, geologically meaningful reservoir models.

Supporting Technologies: SKUA®

The Impact of Dependencies when Assessing Petrophysical Uncertainty for Resource Estimates
Presented by Doug McGuire

Petrophysical analysis plays a key role in the estimation of hydrocarbon resources, and the quantification of uncertainty is central in the definition of proven, probable and possible resources. While Monte Carlo processing is becoming the most popular method for quantifying petrophysical uncertainty, what is often overlooked is the fact that there are a number of different ways in which Monte Carlo processing can be applied to a petrophysical interpretation. The technique chosen determines which of the different types of dependencies can be accounted for. If any of the dependencies are ignored the final uncertainties will be too great, leading to a downgrading of the proven resources for a project.

This presentation examines the different types of dependencies present in petrophysical interpretations and how they affect resource estimates. An example field study is presented where the different types of Monte Carlo processing have been applied, the different results are compared, and the impact of using the different techniques is illustrated.

Supporting Technologies: Geolog®