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Shell's integrated approach to 3D basin modelling

L. SÁNCHEZ RODRÍGUEZ[1], K.K. LIAW[1], A. BRAY[1] AND H.D. WANG[2]

[1]SMEP, Sarawak Shell Berhad
Locked Bag No. 1
98009 Lutong, Sarawak, Malaysia

[2]SIEP, Sarawak Shell Berhad
Locked Bag No. 1
98009 Lutong, Sarawak, Malaysia

Modeling of key factors involved in the generation, migration, accumulation and retention of hydrocarbons is critical to understanding a petroleum system. The major components which need to be understood to unravel the history of a basin include its thermal and burial evolution, the characteristics and distribution of source-rocks, the pore pressure, migration pathways and trap retention. Using Shell's sophisticated forward basin modeling software (Cauldron) it is possible to examine the interaction and, most importantly, the relative timing of these components. Analysis of results allows a more informed assessment of the volume and composition of hydrocarbon fill within identified traps.

Successful basin modeling is an iterative process with key parameters varied within acceptable ranges and results compared to well and field data. Of special importance in this process is the integration of all possible pieces of information to derive a geologically robust story for a given area. Important calibration data from wells includes Bottom Hole Temperatures, vitrinite reflectance, fission track analysis, pore pressures, fluid analysis etc. However, use of other data is also critical to refinement of the models. For instance:

- sonic and density logs may be used to constrain the magnitude of uplift events
- HC-shows maps and fluid inclusion screening (FIS) analysis can be used to constrain HC-migration paths
- Modelled traps can be validated against DHI's (and vice versa!)
- Sonic and density logs can be used to calibrate1D pressure modeling
- location of oil-slicks, gas-chimneys and mud volcanoes can help to constrain low trap-integrity areas from the model
- integration of pressure prediction from seismic velocities will help to validate and constrain overpressure modelling results.

Furthermore, a regional perspective is prerequisite to the full understanding of a hydrocarbon habitat. With this in mind, SMEP has recently focused on producing a regional model covering the whole of the NW Borneo shelf. As a result, smaller (higher resolution) models can now be examined and interpreted in a regional context.

This paper focuses on Shell's integrated basin modeling workflows, and illustrates it with examples from the regional NW Borneo shelf model, as well as from smaller, higher-resolution models covering various areas of the inboard and outboard Sabah regions.

Warta Geologi (Newsletter of the Geological Society of Malaysia), Vol. 29, No. 6, November-December 2003