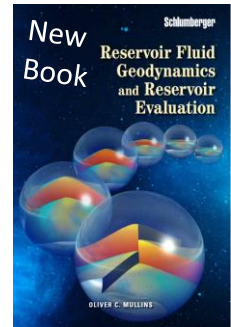


Reservoir Fluid Geodynamics (RFG) and Reservoir Evaluation

SPWLA course: 12 hours over three days.

Instructor and Originator of RFG: Dr. Oliver C. Mullins, SLB Fellow



Reservoir fluid geodynamics is a new technical discipline initiated by the instructor. The primary use of RFG is reservoir evaluation generally to address specific reservoir concerns.

To date, 80 reservoirs have been evaluated through the lens of RFG with 35 Operators; ~1/3 of the studies are published. This course emphasizes reservoir evaluation via WL measurements particularly with formation testers. Nevertheless, RFG provides a platform

of data integration across many disciplines including thermodynamics, PVT, geochemistry, geology, petroleum systems, and reservoir simulation. The course is designed to be useful for petrophysicists, reservoir engineers, geologists, geoscientists of all stripes, and those generally who care about reservoir evaluation.

The RFG course will cover the following:

Understanding the origin of reservoirs, both rock and fluids, enables a much better understanding than simply measuring present day attributes. In the treatment of reservoir rock formations, the G&G group always consider depositional setting and post deposition alterations. Until now, reservoir hydrocarbons were not treated in the same comprehensive manner. Petroleum systems concepts charge the reservoir, the analog of deposition. The recently developed technical discipline RFG accounts for compositional changes and redistributions and phase changes of reservoir hydrocarbons from time of charge to present day. Thus, RFG is essentially the analog of structural geodynamics. RFG required 1) development of asphaltene thermodynamics, 2) downhole fluid analysis and 3) 80 RFG reservoir case studies. RFG has thermodynamic foundations and also complements geochemistry well. The course will provide simple explanations and examples of the requisite thermodynamics and practical geochemistry.

Many RFG reservoir case studies are used to highlight specific reservoir concerns. The first broad application of RFG has been to assess reservoir connectivity; if the reservoir fluids are compositionally equilibrated, the reservoir is likely connected. Another major topic of concern is viscous oil and tar mats; their different origins will be presented. Reservoir simulation is now being used to forecast viscous oil and tar mat formation over geologic time for specific RFG processes. Origins of large and variable GOR gradients are explained; a 20-year puzzle of a complex GOR and asphaltene gradient is now explained simply and modeled with Eclipse simulation. The impact of separate gas and oil charges on asphaltene instability is discussed in case studies. Biodegradation and fluid gradients from, both in-reservoir and spill-fill origins, will be covered, along with water washing and gas washing of reservoir crude oils.

The interplay of geology and fluids is treated; because fluids respond to their container, the co-evaluation of reservoir geology and fluids is coherent. Fault block migrations within charge sequences are shown. For turbidites, indications of paleoflow directions, and channel vs sheet deposits from image log evaluation are integrated with fluid measurements to address connectivity. Fault relay ramps are discussed in terms of aquifer support and timing of charge. Reservoir simulation of charge validates conclusion. The impact of deformation bands is illustrated in both extent of fluid equilibration and well test results. A detailed fluid study of injectite reservoirs is shown. Disequilibrium of very recent charges with possible production implications are discussed. Workflows are shown to address the next unique reservoir.



Dr. Oliver C. Mullins, a chemistry, is an SLB Fellow and member, U.S. National Academy of Engineering. He initiated “reservoir fluid geodynamics” which accounts for fluid compositional redistribution and phase changes during and post charge over geologic time. RFG is founded on asphaltene thermodynamics which his team developed. RFG utilizes downhole fluid analysis which Dr. Mullins initiated. He authored two books, coedited 3 books, coauthored 17 book chapters and 320 papers.

He coinvented 143 allowed US patents. He has 29,000 citations on google scholar. He has received several international awards from four different organizations including: the SPWLA Gold Medal for Technical Achievement, the SPE Anthony F. Lucas Gold Medal, the SPE International Reservoir Description and Dynamics Award, the George A. Olah Award in Hydrocarbon or Petroleum Chemistry from the American Chemical Society, Pioneer in Energy Research from the American Chemical Society and the *inaugural* ADIPEC Lifetime Achievement Award for Outstanding Technical Excellence to the Oil and Gas Industry.