London Petrophysical Society

LPS One Day Seminar
Thursday 11th December 2014, 9am - 5pm
The Geological Society, Burlington House, London W1J 0PG

Reservoir Fluids – Sampling & DFA, PVT & EOS, Waxy oils, Acid Gases, Asphaltenes & Water Chemistry

Time	Presentation	Presenter, Affiliation
09:00	Registration	
09:15	Welcome & Introduction	Michael O'Keefe, LPS
09:30	Interpreting compositional and pressure gradients	Brian Moffatt, Petrophase
10:10	Fluids Integration - There is no 'Silver Bullet'	Shyam Ramaswami, Shell
10:50	~ Break ~	
11:10	Hydrocarbon Phase Behavior and PVT Analysis	Javed Haneef, University of Leeds
11:50	Using EoS fluid modelling to integrate subsurface and surface; experiences in heavy oil developments, Kurdistan.	Eduardo Luna-Ortiz & Igor Bagno, Xodus
12:30	~ Lunch ~	
13:20	Challenges on Characterization of True Waxy Crudes	Gerard Runham, Tullow Oil
14:00	Challenging Fluid Properties: Oil Viscosity, acid Gases	Michael O'Keefe, Schlumberger
14:40	~ Break ~	
15:00	Formation Water - Sampling, Analysis & Modelling	Ross McCartney, Oilfield Water Services
15:40	Effect of Elapsed time on sample contamination levels	Carmen Elena Vietez, Baker
16:20	DFA coupled with Asphaltene EOS	Oliver Mullins, Schlumberger
17:00	Final Comments	
17:30	President's Evening at the King's Head	

Presenter: Brian Moffatt
Company: Petrophase
Title: Interpreting compositional and pressure gradients.
Abstract:
This presentation shows how gradients can be interpreted for both fluid properties and composition in support of field development. Reservoir gas density is strongly influenced by the presence of contaminants such as CO2. A pressure gradient was used to infer CO2 levels in an unsampled formation. Compositional gradients containing contaminants such as mercury or mercaptans can also be used to predict changing concentrations throughout field life.

Fluid equilibrium calculations can confirm if oil and gas are in contact or not. When combined with reservoir densities it is possible to infer the composition of a gas cap which could not be directly sampled. Similarly predicting feasible phase densities below saturation pressure can usefully constrain pressure gradient interpretation. Several case studies identifying and using gradient will be presented and their applications to field development demonstrated.

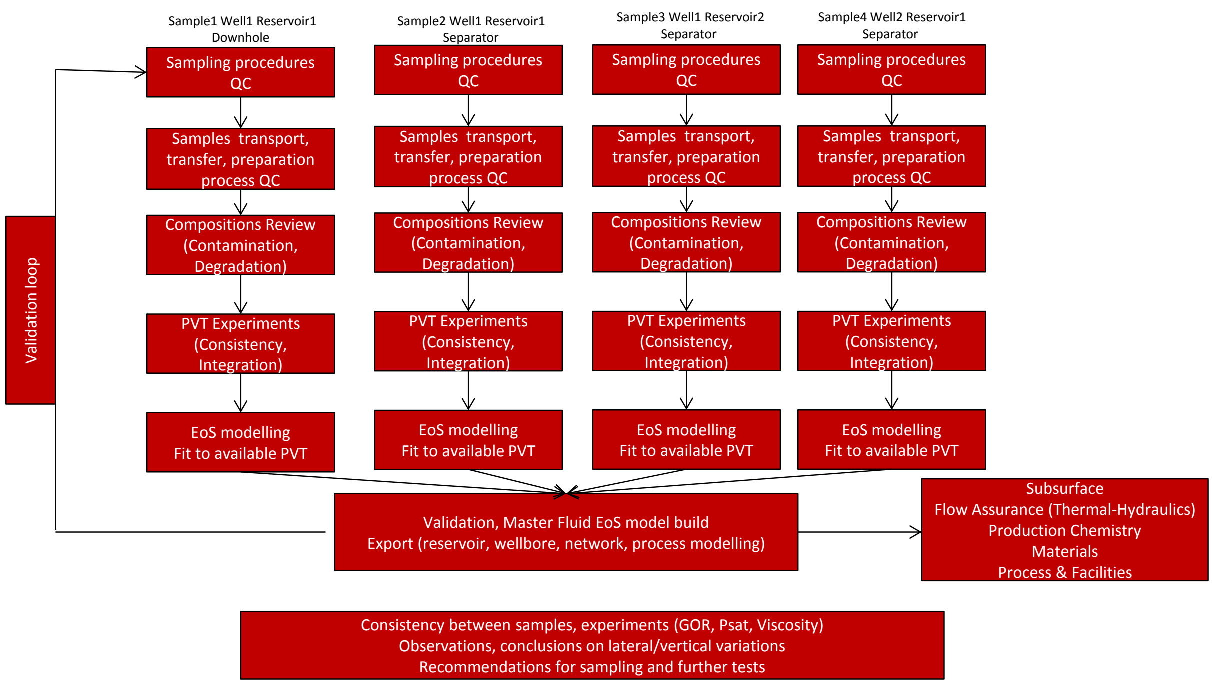
Presenter: Shyam Ramaswami
Company: Shell
Title: There is no Silver Bullet
Abstract:
The integration of different sources of fluid data is essential to arrive to robust fluid evaluation results. Individual datasets may be misleading or hiding elements of the truth and it is important to honour the various elements of fluid properties even if they dont necessarily converge. This talk looks at the evolution of fluid data which drives realtime decisions while a well is drilled and evaluated along with subsequent post well analysis including formation tester interpretation, pvt, geochemistry and flow assurance data. This allows the definition of how fluids look like and vary in a reservoir.

Presenter: Javed Haneef
Company: University of Leeds
Title: Hydrocarbon Phase Behaviour and PVT Analysis: EOS development, its background and modelling
Abstract:
The effective management of hydrocarbon production is required a detailed behavioural analysis of its components. In this regard their physical properties prediction play a very vital role. The behaviour of reservoir hydrocarbon can be evaluated by its PVT (Pressure-Volume-Temperature) relationship. PVT analysis plays a major role in petroleum reservoir filed development and facilities design. In this regards, development of equation of equation of state (EOS) of specific reservoir is the key point for future prediction. This PVT relationship (EOS) is used to describe the volumetric behaviour of hydrocarbon at pressures close to the atmospheric pressure for which it was experimentally derived.

Several EOS are available and used in industry with some limitations and advantages. In this presentation the development of EOS with its background is discussed. The discussion about the limitation of real gas equation and its further development by Van der Wall is presented. Then a review is given for the advancement in vdW equation by Redlich-Kwong, Soave-Redlich-Kwong, and Peng-Robinson. In second part the EOS modelling key steps are discussed and in third part one simulation example is discussed.

Presenter: Eduardo Luna-Ortiz and Igor Bagno
Company: Xodus Group
Title: Using EoS fluid modelling to integrate subsurface and surface: experiences in heavy oil developments, Kurdistan
Abstract:
It is common that fluid analyses are being performed by different engineering disciplines in isolation without any communication between the parties. This will cause the development of different fluid data that are fit-for-purpose for each discipline, each with different assumptions and goals. In consequence, it is often that assumptions (and results) are difficult to reconcile through all the disciplines. Here, we propose a workflow that serves as an umbilical cord to tie the subsurface and surface together with, which becomes particularly useful in for example Field Development Plans.

Providing consulting services to a number of companies operating in Kurdistan region of Iraq, Xodus has compiled experience and regional knowledge on reservoir fluids. Some similarities were drawn along the testing conditions, lab practices and the fluids themselves. Without sharing the actual data, some background information will be given as to the 'things to avoid', 'what to concentrate on' and 'how to get the best out of sampling and testing'.



Presenter: Gerard Runham
Company: Tullow Oil
Title: Challenges Around Sampling, Characterization and Mitigation of True Waxy Crudes
Abstract:
Wax problems in crudes are well established phenomena with defined techniques used for characterisation and strategies applied for mitigation. What is less common are, what is termed here as

‘true waxy crudes’. These true waxy crudes demonstrate very high wax contents and significant flow issues, at even high ambient temperatures, which dominate the flow assurance strategy and CAPEX spend.
Fields in East Africa, Western Sahara, India and China exhibit these very waxy crudes. This presentation details efforts to fully characterise and develop mitigation strategies for waxy crudes in East Africa. These atypical crudes present a number challenges through a development that must be fully understood to minimise CAPEX / OPEX. The workflow and challenges for these waxy crudes is detailed from wellsite sampling, fluid transfer, suitability of characterisation techniques and how analytical information is applied.

Presenter: Ross McCartney
Company: Oilfield Water Services Limited
Title: Are your formation water analyses representative?
Abstract:
Formation water analyses are an important set of data to obtain during field appraisal. Formation water samples can be obtained from wells (e.g. DST, formation testing) or core (e.g. centrifuged core) and are typically analysed in established onshore laboratories using standard methods. Once reported, they may be used by a diverse range of personnel involved in field development planning and subsequently during production. For those that use the analyses, a key question is: “Are they representative?” That is, do the in-situ formation waters have the same composition as that reported? Similarly, will formation waters at other locations (e.g. other well locations, other reservoir zones, water-leg versus hydrocarbon-leg, etc) across the field have the same compositions?

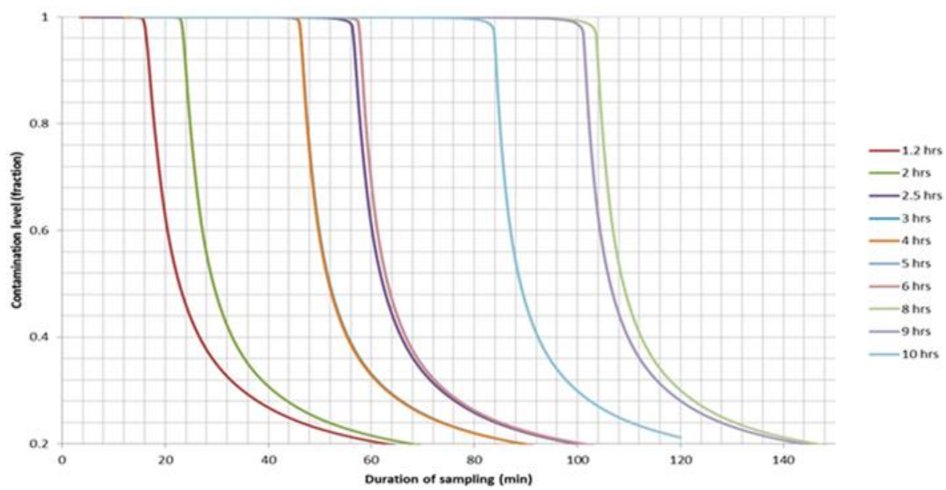
Evaluation of the quality of the formation water analyses can provide answers to these questions although if the analyses are not representative the next question is usually “What is the representative composition likely to be?” In some cases, sufficient information is available for representative compositions to be estimated using a variety of approaches (e.g. use of analogue data, geochemical modelling, etc).

In this presentation, field examples will be given where the quality of formation water analyses has been evaluated and formation water compositions have been estimated. It will be emphasised that an important benefit of this process is that uncertainties associated with the formation water compositions (both the original analyses and estimated values) are identified and so users of these compositions can allow for these uncertainties in their applications.

Presenter: Carmen Elena Vieitez
Company: Baker Hughes
Title: Effect of the elapsed time on single phase samples contamination level.
Abstract:
Formation Fluid Sampling is one of the most costly and time consuming operations in the oil industry. While measurements of rock properties can be done just by moving logging tools along the borehole,

sampling operations are based on setting a tool in contact with the borehole wall often for extended periods of time. The operation is done avoiding vertical or rotational tool movement and even in wireline environments without mud circulation. Under these conditions, there is a considerable risk of getting differentially stuck and loosing expensive sampling tools down hole. Reducing the stationary time on the wall in high risk environments is critical, however in many cases limited pump out time translates into highly contaminated fluid samples.

Each reservoir will have its own challenges during fluid sampling; however one of the main factors to consider when pursuing high purity samples is mud filtrate invasion. This presentation will discuss the change in sample mud filtrate contamination as a function of two variables;
1) Time after drilling prior the sampling process.
2) Clean out time during sampling operation.



Variation of Contamination Level vs Sampling Time due to Time After Drilling

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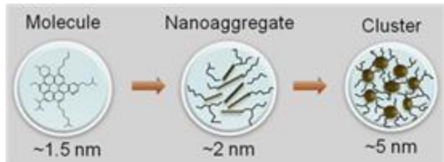
Presenter: Oliver Mullins
Company: Schlumberger
Title: Downhole Fluid Analysis coupled with Asphaltene EOS
Abstract:
The combination of new understanding in the science of petroleum fluids, coupled with advances in downhole technology available on Wireline Formation Testers, is providing a broad array of new applications to address the most important issues operators have in reservoir evaluation and production.

Crude oils are composed of solids, liquids, and gases. The liquids and gases have long been understood in a detailed chemical sense and corresponding gas-liquid equations of state (EoS) are based on the van der Waals equation, developed in 1873, the first cubic EoS. In stark contrast, the solid component of crude oil, the asphaltenes, have long been misunder-stood in virtually all explicit chemical properties, often with orders of magnitude discrepancies. In recent years, the molecular and colloidal structures of asphaltenes in movable reservoir crude oils has been resolved and codified in the “Yen-Mullins Model”.



The formation of tar mats has long been a vexing problem in the industry. If asphaltene instability occurs due to oil-water interaction, then how can tar mats grow to 10 meters thick? But if asphaltene instability happens at the top of an oil column, how does tar get to the base of the column? DFA case studies show that the Yen-Mullins model resolves the key component of the problem.

DFA reservoir case studies with subsequent production establish that the equilibrated distribution of asphaltenes is a strong indicator of reservoir connectivity, generally the most important concern of operators in Deep Water.