Session 1: Tar Mat Characterization

Tar mat, is it precipitated asphaltene or asphaltene is just big portion of tars constituent? Obviously, the group does not have a clear definition of Tar mainly due to different technical approaches (chemical description or solubility properties). Surely two things all agree on; it has high concentration of asphaltene and it does not move. Its definition is questionable, and therefore, there is a need to understand the nature of tar and its physiochemical properties.

If asphaltenes are what tar is made of, then assessment of the asphaltenes precipitation and deposition can help the understanding of tar mat origin and their deposition/formation model. This is critical because mapping its distribution within the reservoir is a critical issue since it impacts business decisions (avoidance of production problems and help development). Modeling asphaltene gradient within the reservoir is now possible with the development of solid based equation of state (FHZ), with some Downhole reading using optical measurements, asphaltene gradient can be predicted and provide information on viscosity trend within the reservoir and could identify compartmentalization.

The geochemical model of the tar mat is important in the understanding of the local to field relation and necessary in the reconciliation of the local investigation on the tar distribution, characterization and the advanced mapping using seismic linked to acoustics properties of tar. A wrong model can lead to wrong understanding of the nature of the tar mat and the local to field relation, which may lead to wrong business decisions. It is important to distinguish the uncertainty of the model from the notion of the risk.

Tar mat mobility, the consensus within the group, it is immobile, but if there is a technology that allows to produce tar or even portion of it, is it bookable reserve, what’s the economics? This is economical and politically critical. The other interesting observation on tar mat zones is the potential presence of mobile within the same zone/layer. A case in a Kuwaiti reservoir showed multi layers of immovable tar, where there are pockets in between with movable heavy oils. Is that related to rock surface and tars are formed, questionable and need further investigation.

Some techniques could be used to identify tar, but possibly requires starting from core to calibrate log measurements so accurate identification of tar can be achieved using different methods. Then link tar identified to acoustic properties, then seismic to map the lateral extension of the tar. Integration of all available data is critical to achieve representative tar mat map. Another approach is to investigate the stability of Asphaltenes in the HC column...
by studying the behavior of a droplet of oil in different solvent mixtures. One of them (Toluene/Heptane) used in the ASCI method allows to define a Solubility index strongly linked to asphaltene composition.

Session 2: Tar Mats Modeling and Simulation

- A presentation by Sameer on Estimating Reservoir Connectivity and Tar-Mats Occurrence using Gravity-Induced Asphaltene compositional Grading. Asphaltene precipitation is not Tar, maybe we need to connect the Asphaltene precipitation to Tar Oil Contact and presence. Then this could be used to identify Tar. May be we need to develop a clear definition of Tar during this workshop.
- A presentation by Ramsin Eyvazzadeh titled Recent developments in Fluid Property Characterization and Modeling. In-Situ viscosity and NMR, can you really identify Viscosity from NMR alone? Without calibration with the labs?
- A presentation by Khalil Al Hosani in Integrating Subsurface Core and Log Data to Model Tar Mat in a carbonate Upper Jurassic Reservoir in Offshore Abu Dhabi, UAE.

Then 3 breakout groups were formed led by Discussion leaders. The breakout sessions were 45 minutes of discussion and 15 minutes to present to the rest of the groups.

Group 1: Ibrahim by Sameer Punnapala (The Petroleum Institute) had the following ideas:

Asphaltene stability curve was discussed during the discussion. The relation between Bubble point pressure and Asphaltene precipitation was also under question. Also under what pressure can Tar Mat start forming? The team agreed that no pressure limits are required for Tar Mat formation. Difference between Tar Mat and Heavy oil was another point of discussion. Where can Tar Mat form and in which location? This will be discussed in session 5 on Wednesday in greater details with the case studies and results.

Group 2: led by Ramsin highlighted the below ideas:

Two work flows:

1. The characterization of Tar Mat:
   a. It has to start in the lab (PVT studies, fluid properties, POPI, etc)
   b. Logs can be used as source not only to identify distribution but also determination of viscosity, Porosity and so on.
   c. Comprehensive data coverage program across the field and not per well.
2. Modeling of Tar Mat:
   a. Establish a separation between the rock and fluid properties
   b. How close can we get to the Tar and identify the transition zone
   c. Modeling Tar to Tar zone,
   d. Asphaltene Model has to be a huge part of building any kind of models
Group 3: Led by Khalil Ibrahim (ADMA-OFCO) noted the following ideas:

In the modeling challenges are:

1- The origin of the Tar Mat is crucial to understand the distribution of the Tar.
2- The structure in order to understand the distribution of Tar Mat in the UAE field.
3- The differential pressure need to be addressed in this field. Data is not available but needs to be gathered in the future. Do we have structured compartmentalization in the field?
4- A suggestion was to use the caliber log to identify the Tar Mat and combined with other available data and adds it to the integrated studies.
5- A question rose at the end, “Are we correlating the same Tar Mat?”
   a. We need to used geo-chemical dinger prints
   b. And Chemo-stratigraphy analysis.
6- To share the data with the workshop members once the development starts. The team is now managing the risks and completely eliminating them.

Session 3: Advanced Technologies to Develop Reservoirs with Tar Mats

- A presentation by Sami Abdelbagi titled Well completion Improvement in Heavy Oil Cold and Hot Production. What are the limitations of POPI from an operation point of view and what is the cut off for the Tar? How do you differentiate between Tar and Pyrobitumen with POPI technology?
- A presentation was delivered by Mounir Ababou titled Production of Thick Crude Through Concentric Coiled Tubing.
- A presentation was delivered by Naim Al-Jabari titled: Near Real Time Tar Detection

Breakout sessions were then formed by the group as follow:

Group 1: Led by Sami Abdelbagi (Saudi Aramco) and they highlighted the following thoughts:

The team was discussing the benefits of POPI in Tat identification. The techniques of POPI were discussed during the session. Contamination was one of the challenges that were discussed and need to be discussed thoroughly. Compositional analysis was developed to eliminate contamination issues. Component volume calculations were also a part of the discussion. Differentiation between different types of Tar is a new idea that needs to be addressed. POPI is an instrumental tool to determine API for Heavy oil and Tar. POPI can be instrumental in optimizing testing intervals especially in exploration wells.
Group 2: Led by Mounir Ababou (Baker Hughes) and discussed the following ideas:

One of the questions was about the possibility of permanent CCT installation. And the answer is yes. CCT can be essential in collecting samples for Tar identification. The possibility of stimulating during analysis with CCT is one of the advantages that were highlighted. The CCT can be a solution in other parts of the world such as Venezuela. The crude in Venezuela is quite heavy and can be produced with the help of CCT technology. This application was actually performed in Oman. The team would like to receive more details about this technology and application. Mobility and viscosity are quite crucial for CCT technology to help in Tar sampling, lift to the surface etc. Solvents injection can be done with CCT technology; however, we need to be cautious during injection to avoid damage to the formation. Lack of petro-chemistry studies is an industry challenge that if solved can also support the identification and understanding of Tar formation.

Group 3: Led by Naim Al-Jabari (Halliburton) and came out with the below points:

The team discussed going in details about the planning phase of the chemo-stratigraphy. The planning phase was discussed in details covering many phases.

The limitation associated with simpler techniques were also discussed. Oil based mud could totally throw off CS analysis. Experience of the individuals analyzing the samples is also another factor.

CS different from stratigraphy or even Bio-stratigraphy. Should it be called Chemo signature rather than chemo-stratigraphy?

Chemo-stratigraphy needs to be linked with other analysis to be beneficial but should not be used as a standalone tool for Tam identification.

Session 4: Well & Reservoir Characterization

The session focused on tar identification and various techniques in use to map tar distribution for well placement and developing production, injection strategy. It was stated that no single methodology can be used to map the vertical and lateral tar distribution. However an integrated approach using pressure, geochemical, open hole logs, NMR can be used for reliable development strategy.

A novel method was discussed to enhance production. This method called DHSG (Down Hole Steam Generation) stating that it helps exploit deeper formations and improve thermal efficiencies. The principle is to start injecting water alternating with CO2/N2/O2 for optimal reservoir response. Accordingly, percentage of the aforesaid can be altered to drive the reservoir response.

Other technologies we presented which includes CCS, SD and SAGD to develop heavy oil/tar in one of the field as a case study.
Session 5: Case Studies and real results

- A Presentation by Tariq Matarid titled Innovative Integration of Seismic and Well Data to Characterize Tar Mat in Carbonate Reservoirs. Discussion rose on different geological structure and the variation of the wave length of the Seismic across the reservoir.
- A Presentation was delivered by Honggang Zhou titled The Origin of the Fluid Properties Variation and the Tar Mat. The newly developed ASCI method was of great interest to the team. The participants suggested to integrate all developed methods of Tar identification in order to improve current industry standard.
- A Presentation was delivered by Naim Al-Jabari titled: How to identify Tar in Heavy Oil Reservoirs. Although most of the real cases were discussed at South America (except for one in Kuwait) but the outcome of the new differentiation between Tar and Heavy oil is quite promising. The team inquired about the NMR techniques and possibility of integrating some of the logging data with POPI and Labs at a faster base in order to support the running operations.

Group 1: Led by Tariq Matarid (ADMA-OPCO) and they highlighted the following thoughts:

Although the practices are different from on operators to the other but the intend is the same. Some operators plan their wells above the Tar level where others go below it. The group would like to know if the field in UAE will produce in the higher porosity part of the field. The field will be developed in the next two years and more wells are planned to be drilled. The intention is to gather more data during the development of the field.

Group 2: Led by Honggang Zhou (Total) and discussed the following ideas:

The group discussed the location of the Tar within the reservoir and possibility of being in line with the water contact with paleo oil.

Group 3: Led by Naim Al-Jabari (Halliburton) and came out with the below points:

The group suggested that with the new Tar identification method, it is required to combine NMR with conventional logs and formation tester to assure mobility. Caliper can also be used as index for Tar. NMR should not be run in every well but should be run in crucial wells.