



October 2010 | Gushor Inc. | (403) 210-7594

# Gushor Inc. Newsletter



## Viscous variations and asphaltic aspirations!

By: STEVE LARTER, CHIEF EXECUTIVE OFFICER – GUSHOR INC.

It is now well known that heavy oil and oil sands reservoirs show oil viscosity gradients at many scales both vertically and laterally in the reservoir (Larter et al, 2008). These viscosity gradients reduce in absolute magnitude when the reservoir is heated but do not disappear, so even at steam temperatures significant viscosity gradients remain, affecting fluid mobility at production. In a recent talk at the AAPG, ICE conference in Calgary, Ian Gates analyzed the impact of vertical and lateral viscosity gradients on steam chamber development and SAGD process startup in typical Albertan bitumen reservoirs.

In SAGD startup, steam is circulated in one or both wells, the objective being to heat the region between the wells to a target temperature (really a target oil viscosity) so oil can be mobilized to initiate a steam chamber along the entire length of the well pair.

If oil viscosity varies horizontally along the well, as it usually does in our experience, then the time for oil to reach the target viscosity varies and it is impossible to get a uniform viscosity and oil mobility along the well pair. Given that oil mobility varies (even if the reservoir is heated), when SAGD mode is initiated, injectivity varies and Ian's study showed a non uniform steam chamber is established at startup with hot and cold spots along the well where steam flow is high or low. Surprisingly these cold spots are quite resilient with time and it appears that startup is far more crucial to establishing the main injection routes for steam into the reservoir and the final CSOR and recovery factor values than might be expected. Thus a fully mobilized inter well oil zone before SAGD startup makes a huge difference to final economics and oil productivity. While steam allocation control can remedy some startup and reservoir issues, a good startup really does make a difference and is easy to assess and design before you start injection of steam. Assessing the vertical and lateral oil mobility field prior to startup is easily achieved on a routine basis with vertical and lateral oil viscosity profiling and reservoir characterization and can be used to define SAGD startup conditions and startup duration. A cold engine never works well and wears badly; neither so it seems does a SAGD process.

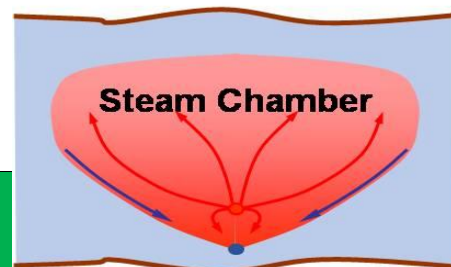
To assess lateral and vertical viscosity gradients in bitumen or heavy oil reservoirs several methods are available to obtain viscosity data from core or cuttings. The Gushor plunger platform recovers clean oil from core and many cuttings samples and the recovered oils retain the crucial light ends that affect viscosity measurements so much (Adams et al, 2008). Good quality horizontal well cuttings also, if properly collected and processed, can often provide directly determined viscosities for oils so lateral viscosity gradients can be routinely assessed. Gushor's ProxVisc™ technology even allows high quality viscosity data to be recovered from analysis of cuttings samples where mud contamination of the oil has occurred. Horizontal or vertical well cuttings samples are not waste products to be thrown away; they can be incredibly valuable resources to assess lateral viscosity gradients in many heavy oil and oil sand reservoirs.

Definition of oil mobility prior to a recovery process being designed or initiated is crucial to economic and environmentally benign recovery of energy from heavy oil and oil sand reservoirs!

A battery of tested oil viscosity assessment tools are available for your unconventional reservoirs so for more information on this topic, or any other Gushor services, please contact us at [info@gushor.com](mailto:info@gushor.com) or visit our website at [www.gushor.com](http://www.gushor.com).

Year: 2010, Issue 4

SURFACE



## Gushor Inc. Services

### Geosciences Solutions

- **Petroleum Systems Analysis**
  - Exploration
  - Development
  - Production
- **Analytical Services**
  - Heavy & Conventional Oil
  - Water Chemistry
  - Gas Analysis
  - Geochemistry
- **Geosciences Software**
  - GNAWD Pre-drill API/Viscosity

### Engineering Solutions

- **Reservoir Engineering**
  - Enhanced Oil Recovery
  - Advanced Reservoir Description
  - Steam/Solvent Scheduling
- **Reservoir Simulation**
  - SAGD, CSS, ES-SAGD
  - Reservoir Characterization
  - Well Performance Forecast
- **Reservoir Production Analysis**
  - Type Curve Construction
  - Production Decline Analysis
  - Trend Analysis
- **Engineering Software**

### Technology Applications

- Plunger™ (lab and field)
- GVisc™
- ProxVisc™
- Carbonates

### Unconventional Wisdom

- Reduced Emission Recovery
- Carbon Management
- Biodegradation
- Fluid Mobility
- Heavy Oil Recovery

### Gushor Education



## Gushor Presents at EAGE Workshop in Manama, Bahrain (September 26-29, 2010)

Barry Bennett and Steve Larter travelled to Manama, Bahrain to represent Gushor Inc at the Second European Association of Geoscientists and Engineers Workshop on Tar Mats and Heavy Oil: Nuisance or Resource?

Steve Larter and Barry Bennett presented a short course on "The origin, characterization and impact of oil mobility variations on energy recovery from heavy oil and bitumen reservoirs – A review of the Science and Engineering and a forward look at the new technologies needed". The course was well attended and we believe well received.

What was clear from the subsequent workshop was that current technology and tools for characterizing heavy and bitumen resources and tar mats fall way short of expectations with many attendees stating the need for new technology in this area. For one thing, heavy oil and bitumen are often immobile or weakly mobile under natural reservoir conditions and thus often do not flow easily into sampling tools for subsequent determination of API, viscosity and PVT properties and in the complex reservoirs, downhole electric logging methods may struggle to even resolve hydrocarbon fluid signals from background reservoir and water, let alone provide any usable viscosity assessments. Core samples and the Gushor Plunger system seem to be one of the few approaches actually demonstrated to be able to get accurate oil viscosity data in complex Middle East reservoirs. The Plunger facilitates rapid (30 mins) extraction of clean (with respect to water and solids) oil and bitumen samples from core (and some cuttings) with properties ranging from <1,000cP to 10's of millions of cP at 20°C. The plunger, when installed at rig site together, with a Rheometer, provides the best viscosity data possible avoiding the serious issues that surround sample preservation and storage and its impact on oil viscosity data (Adams at al., 2008). While the day time surface temperatures in the Middle East are much higher than reservoir temperatures in Fort McMurray, Alberta, the problems of oil characterization remain the same and unconventional reservoirs still require unconventional solutions not conventional technologies applied in inappropriate reservoir settings.

The meeting showed several interesting case histories and also showed that the Middle East heavy oils, while sometimes having been formed by biodegradation, at other times also commonly have features indicative of classical tar mats which form by a quite different mechanism of in reservoir phase separation. Tar mats have implications both for crude oil reservoir charging, exploration and exploitation. On the exploitation side

a predictive model of tar mat occurrence and areal extent is beneficial for field development and enhanced oil recovery procedures. Petroleum reservoirs with tar mats can have production deasphaltation problems associated with them because tar mats can represent flow barriers to water injection programs and consist of viscous or non-producible oil in-place. Tar mats can potentially give also indications of the filling history of a given reservoir (Wilhelms and Larter, 1994, 1995). While asphaltene science has developed extensively in the last decade and several presentations showed the advances clearly, it was interesting to see that work done many decades ago on the origins of tar mats in the N.Sea and USA, still seems current when looking at tar mat accumulations and in-reservoir asphaltene deposition (Wilhelms and Larter, 1994; 1995). Today, with more modern analytical capabilities, our characterization of tar mats and associated light and heavy oils is even more definitive.



### Key Company Contacts

#### Steve Larter

Chief Executive Officer  
slarter@gushor.com

#### Barry Bennett

Director of Geosciences  
bennettb@gushor.com

#### Lloyd Snowdon

Director of R & D  
lsnowdon@gushor.com

#### Dennis Jiang

Laboratory Manager  
cjiang@gushor.com

#### Richard Stephens

Business Development Manager  
rstephens@gushor.com

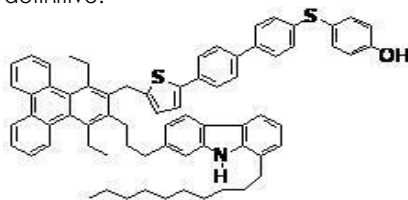
Gushor Inc.  
Unit#15, 3535 Research Road NW  
Calgary, Alberta T2L 2K8  
(403) 210-7594  
(403) 210-7996  
Info@gushor.com

Geosolutions for Unconventional Systems &  
Heavy Oil Recovery

Find us on the Web: [www.gushor.com](http://www.gushor.com)

The workshop was well organized by EAGE and many talks showed the synergies between the understandings of Canadian and other heavy oil systems and the Middle East heavy oils and tar mats.

For more information on this course please contact us at [info@gushor.com](mailto:info@gushor.com), or [www.gushor.com](http://www.gushor.com).



### References

1. Wilhelms, A. and Larter, S.R. (1994). Origin of tar mats in petroleum reservoirs. Part 1: introduction and case studies. *Mar. Pet. Geol.* 11, 4, 418-441.
2. Wilhelms, A. and Larter, S.R. (1994). Origin of tar mats in petroleum reservoirs. Part II: formation mechanisms for tar mats. *Mar. Pet. Geol.* 11, 4, 442-456.
3. Wilhelms, A. and Larter, S.R. (1995). Overview of the geochemistry of some tar mats from the North Sea and USA: implications for tar-mat origin. *The Geochemistry of Reservoirs* (Eds Cubitt J.M. & England W.A.). Geological Society Special Publication No. 86, 87-101.
4. J. Adams, C. Jiang, B. Bennett, H. Huang, T. Oldenburg, K. Noke, L. Snowdon, I. Gates, S. Larter. (2008). Viscosity Determination of Heavy Oil and Bitumen: Cautions and Solutions. World Heavy Oil Conference. March 2008.
5. Larter, S., Adams, J., Gates, I. D., Bennett, B. and Huang, H. (2008). The origin, prediction and impact of oil viscosity heterogeneity on the production characteristics of tar sand and heavy oil reservoirs. *Journal of Canadian Petroleum Technology*. January 2008. Volume 47, Issue 1. pp.52-61.