

Predicting PVT and Flow Assurance Properties

Heavy oil challenges – API and viscosity estimates

OilTracers LLC routinely helps clients address heavy oil fluid property prediction challenges that arise due to:

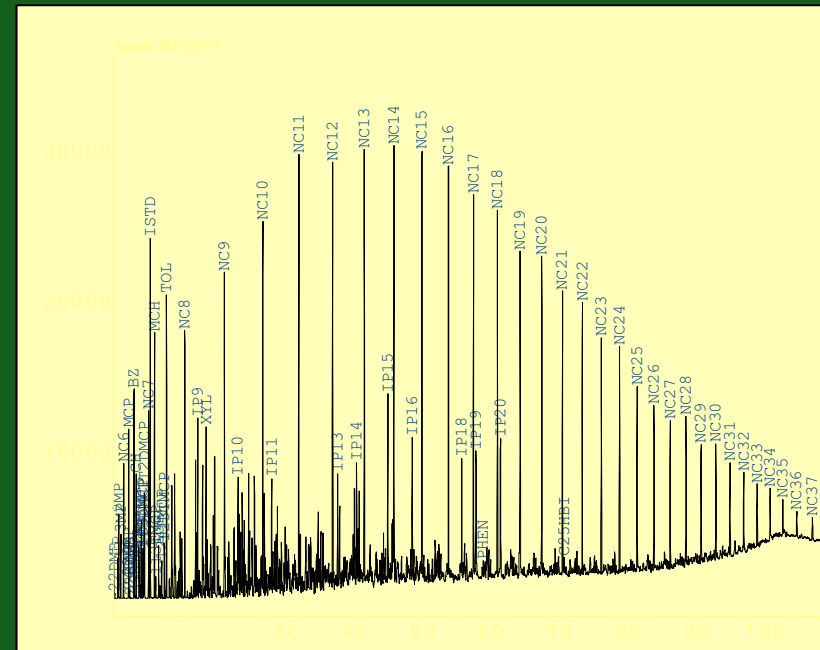
- Biodegradation – a process that reduces oil quality and value, e.g., by decreasing API gravity and increasing sulfur, metals, TAN and viscosity.
- Low mobility – difficulty in flow testing exploration wells can result in no oil samples that are suitable for direct measurement of their physical properties.
- Extreme variability of oil quality within a reservoir – even a successful flow test might not account for the true range of fluid properties.

Samples can be extracted from core plugs and sidewall cores to provide inexpensive oil quality information. In some cases however, direct measurements of extract physical properties are unreliable due to OBM contamination, insufficient volumes or evaporation during handling. Geochemical interpretation of molecular attributes has enabled good oil quality predictions in many cases where direct physical property measurements failed.

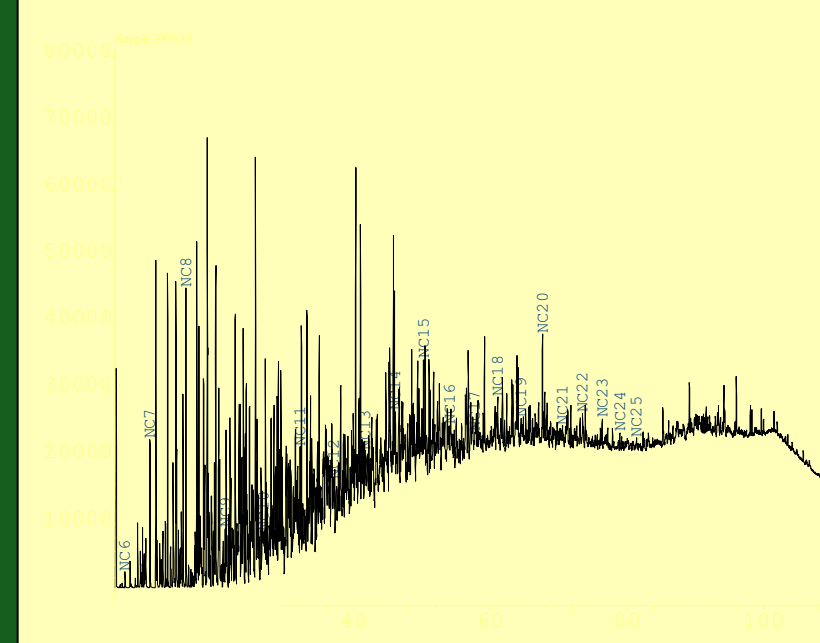
We will work with you to find the most robust sampling, analytical and interpretation solution for your heavy oil prediction requirements.

Whole oil GC method – one of many options

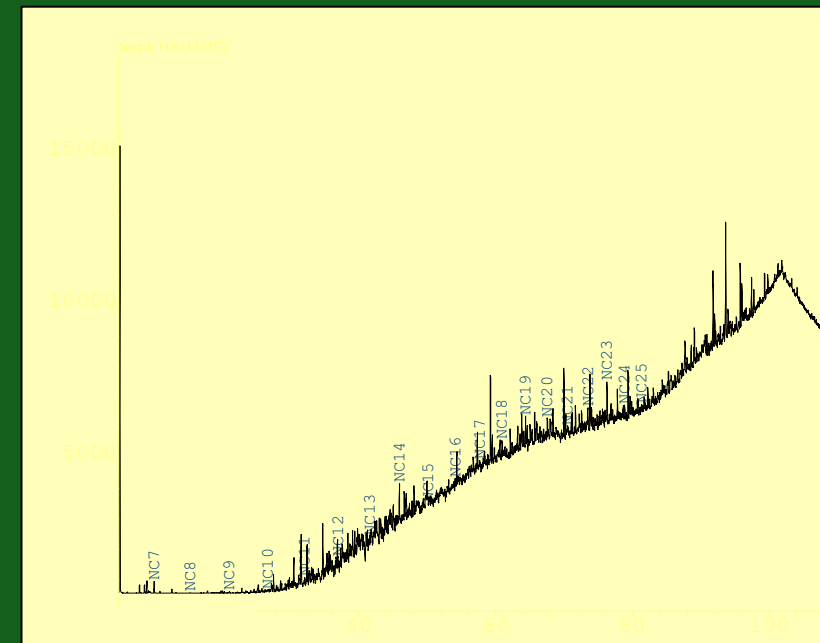
GC of unbiodegraded core plug extract



GC of moderately biodegraded core plug extract



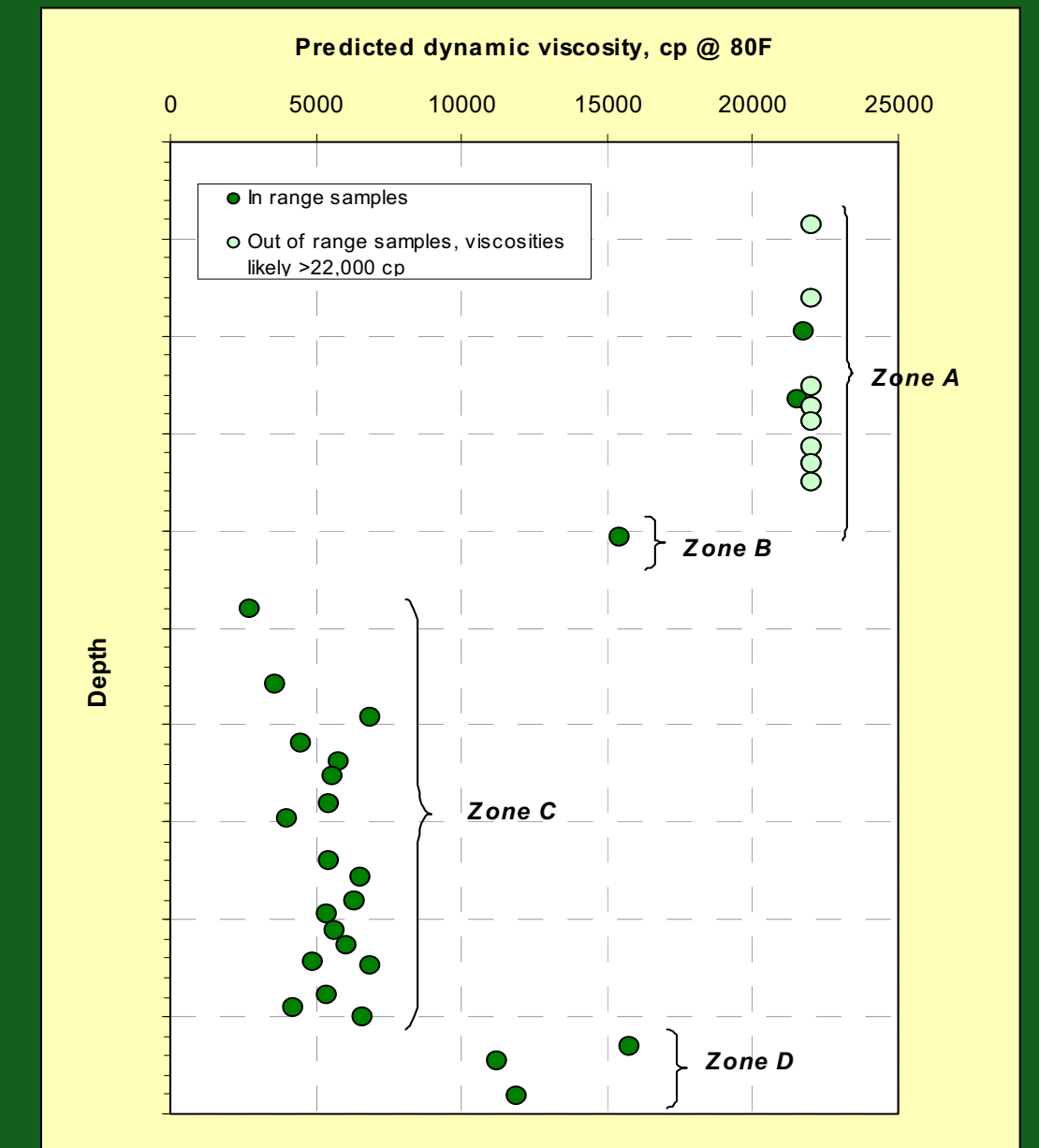
GC of heavily biodegraded core plug extract



- Characterize molecular parameters known to be associated with biodegradation – frequently petroleum system specific
- Develop empirical correlations for fluid property predictions
- Acquire and correctly handle SWC and/or core plugs
- Perform extract GC
- Interpret

This is one of the recommended low-cost options when calibration oil data are available

Continuous profile of oil quality established using frozen core plug extracts. An empirical scheme relating measured viscosity to biomarker, saturate and aromatic compounds was developed using test fluids. This scheme was then applied to core plug and sidewall core extracts for viscosity prediction.



Fluid property estimates from dead oil samples

OilTracers' services include interpreting the molecular attributes of dead oil samples that bear directly on PVT and flow assurance properties. These attributes include:

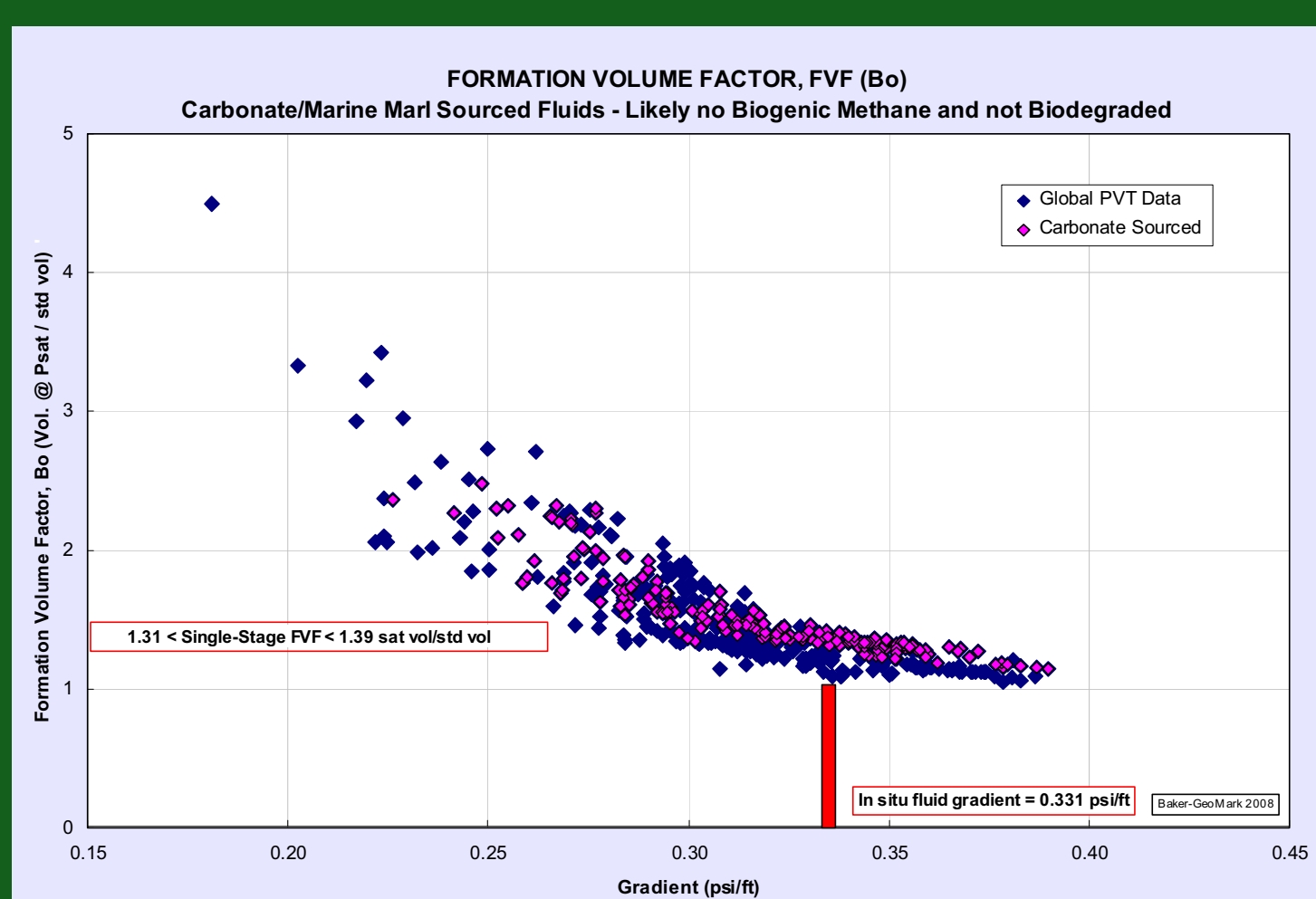
- Source rock type
- Source rock maturity
- Reservoir alteration (e.g., biodegradation or evaporative fractionation)

We interpret these attributes within the petroleum systems context, drawing on appropriate analogue data and integrating dead oil property data such as:

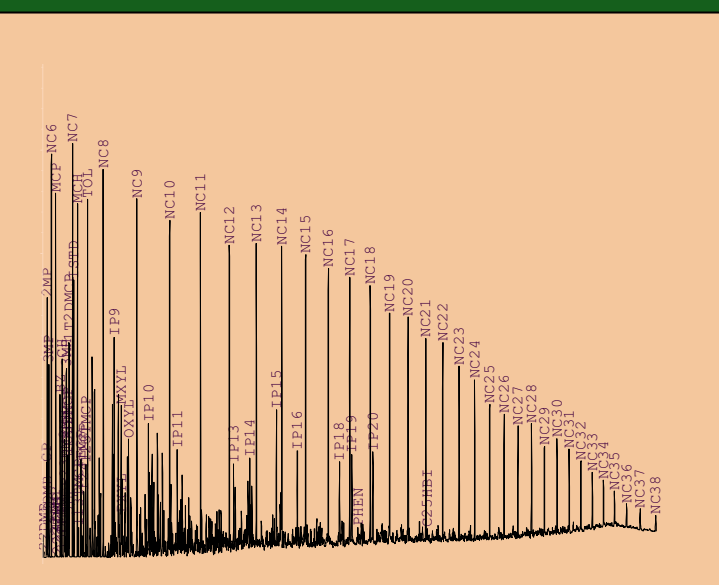
- API gravity
- SARA (saturate-aromatic-resin-asphaltene)
- Sulfur and metals

With the addition of in situ fluid density information, high quality predictions of fluid properties are possible using PVT^{MOD}.

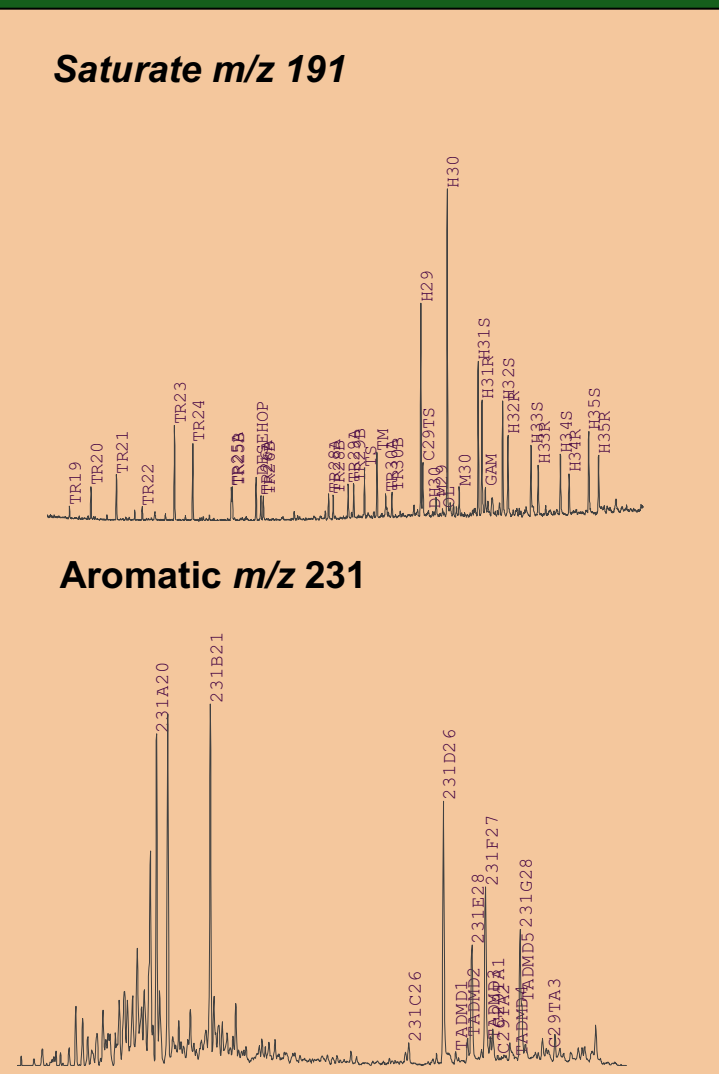
Example prediction of Bo using Geomark's PVT^{MOD} based on measured in situ gradient and geochemical interpretations



Whole oil GC of dead oil sample



Saturate and aromatic biomarkers are critical to decipher oil source, maturity and alteration



Data courtesy of Baseline Resolution, Inc à la Carte sample library



Opportunity evaluations in data-limited settings – PVT and flow assurance predictions

Oil accumulations that were non-commercial when discovered are attractive low risk development candidates for some companies. A common challenge, however, is that in many cases these discoveries were inadequately or incompletely tested.

Geochemical analysis and interpretation of dead oil samples can provide the fluid descriptions necessary for engineering and economic assessments of these opportunities. A typical evaluation might comprise:

- Analyses of dead oil samples – commercial libraries have extensive global sample databases (search 33,500 samples at www.oiltracers.com)
- Compilation and interpretation of relevant analogue field geological and engineering data and petroleum systems evaluations
- PVT modeling. When the data permit, we recommend PVT^{MOD} (see Geomark Research, Ltd. Production Services at www.geomarkresearch.com)

OilTracers L.L.C.

www.oiltracers.com