AMPLIFIED GEOCHEMICAL IMAGING LLC

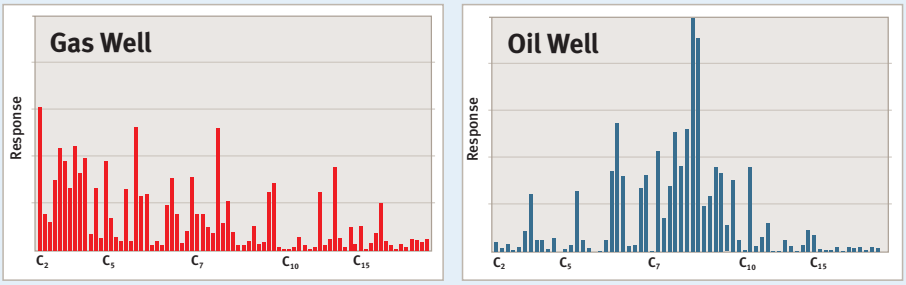
DOWNHOLE GEOCHEMICAL LOGGING

Downhole Geochemical Logging

This application uses proprietary Amplified Geochemical Imaging℠ technology to directly characterize the composition of hydrocarbons vertically through various prospective sections by analyzing well cuttings. This technology is unique in that it has the ability to look at a broad compound range from C_2 to C_{20} at part per billion (PPB) levels and may be the only technique to deliver hydrocarbon data on cutting samples from C_6 – C_{15}. The C_2 to C_{20} hydrocarbon range is significantly more expansive than the limited traditional ranges of C_1 – C_5 from mud logs or C_1 – C_9 from alternate techniques. It also separates and quantifies approximately 80 individual compounds as opposed to the traditional nine. The result is a broad characterization of petroleum phase contained in the stratigraphic intervals down the well.

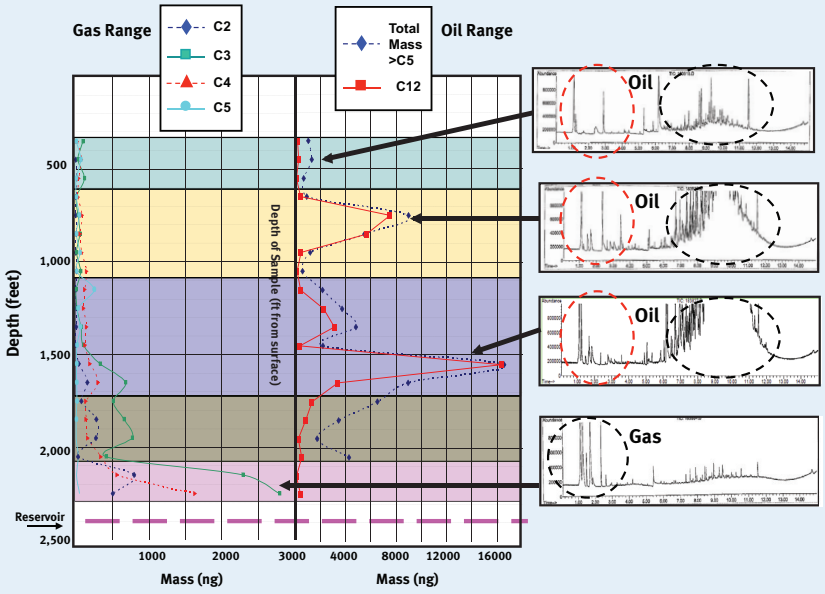
Hydrocarbon Phase Identification

The extensive compound list not only makes it easy to differentiate between gas, gas condensate, and oil signatures, but also provides the ability to differentiate between multiple oil signatures in fields with stacked zones in which multiple oil or gas signatures are present (e.g. the Bakken, Eagleford, or Barnett).



Compartmentalization & Seal Rock Integrity

Additionally, the ability to differentiate between multiple hydrocarbon signatures through various vertical sections, as well as the extreme method sensitivity, provides the ability to infer compartmentalization that may not be detected by traditional well logs. As seen in this example, the unique oil signatures in these three formations imply potential compartmentalization between the three oil bearing zones.



Downhole survey in Wayne County, New York State. 20 samples taken at 300 to 2,300 feet.

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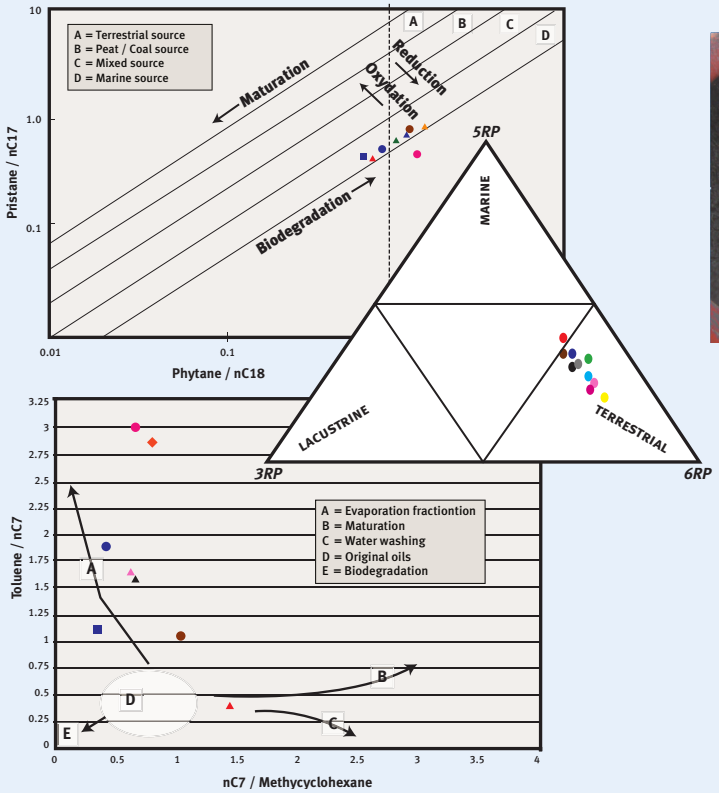
Stratigraphic Correlations

In areas of a field where there is little well control or where the stratigraphy may be uncertain, this technology can be used to identify the hydrocarbon fingerprint of cuttings from unknown stratigraphic sections by comparing the hydrocarbon signatures to cuttings signatures on previous wells.

For example, it is possible to differentiate oil from Bakken formation cuttings as compared to oil from Three Forks cuttings due to their different oil chemistry. This differentiation can be invaluable for completion schemes and horizontal drilling efforts when one formation is known to be more productive and more economic than another.

Reservoir Quality

The extensive compound list, C_2 to C_{20}, also allows the data to be incorporated into geochemical interpretive charts to evaluate various reservoir or hydrocarbon properties such as thermal maturity, depositional environment, oxidation, water washing, proximity-to-pay, and biodegradation.



Bypassed Pays

Due to its extreme sensitivity, PPB level detection, this application can detect bypassed zones that may be missed by conventional logging techniques and other geochemical methods. This can be particularly true in under-pressured tight sands where traditional well logs do not detect gas shows.

Overview

Drill cuttings are collected from the mud pit and placed into a module jar as the well is drilled. Cutting sampling locations can be chosen at regular intervals or more closely spaced intervals whenever a section of interest is reached. Once the collection jars are received by AGI's laboratory, the cutting samples will be analyzed using thermal desorption followed by gas chromatography and mass spectroscopy (GC/MS). Since thermal desorption is used instead of solvent/chemical extraction techniques, the resulting chromatogram more closely resembles traditional oil fingerprints. Results are typically provided within two weeks from the time the samples arrive in the laboratory.

Top: Cuttings sample collection at the shaker table

Bottom: Controlled module exposure to cuttings

(Courtesy of Merty Energy)

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