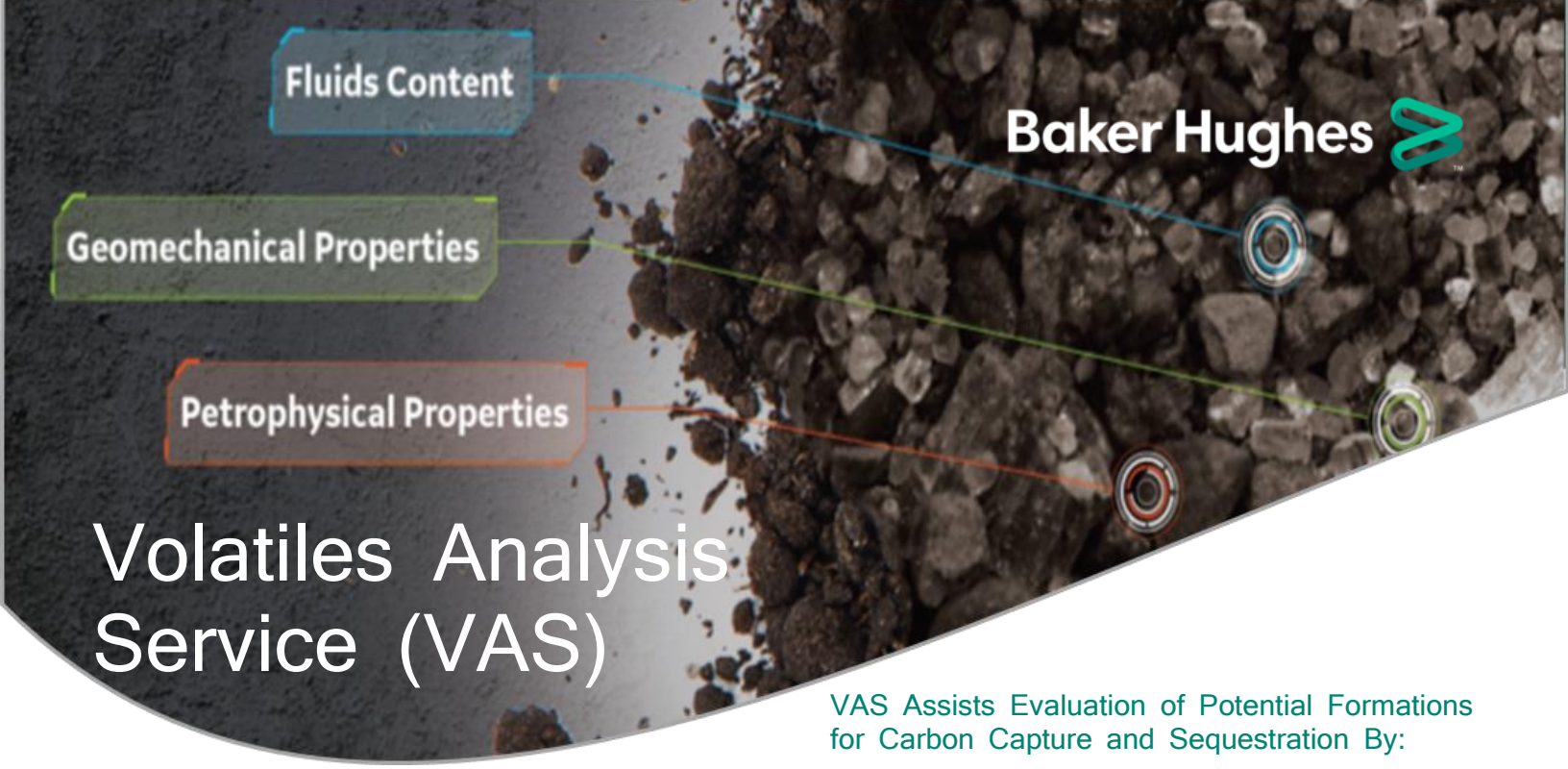


Volatiles Analysis Service (VAS)

Evaluate Suitability of Formations for Carbon Capture and Sequestration

The Volatiles Analysis Service (VAS) from Baker Hughes, supplied by Advanced Hydrocarbon Stratigraphy, a Baker Hughes strategic partner, is an advanced geochemical analysis that provides detailed information on the composition of entrained volatile chemistries from geological materials (PDC cuttings, rock bit cuttings, side wall core, core, etc.) be they legacy (several years/decades old) or hermetically sealed at the well site. The volatiles monitored are extensive and provide unique insights into the geochemistry of the subsurface system in addition to providing a mechanical strength index and permeability indices.

Volatiles Measured by VAS Include:

- Carbon Dioxide
- Water
- Helium
- Argon
- Molecular Oxygen
- Molecular Nitrogen
- Hydrogen Sulfide
- Carbon Disulfide
- Carbonyl Sulfide
- Methyl Ethyl Ketone
- Formic Acid
- Acetic Acid
- Ethene
- 2-Trans-Butene
- C1-C10 Hydrocarbons

Additional species, isotopes, and/or isomers may be possible upon request

VAS Assists Evaluation of Potential Formations for Carbon Capture and Sequestration By:

1. Assessing the risk of CO_2 communication into/out of the target formation
2. Evaluating the sourcing of CO_2 already present in the subsurface

CO_2 Communication in Target Formation

A major goal of carbon capture and sequestration (CCS) projects is to ensure that the CO_2 remains sequestered in the target formation. VAS data across multiple basins has informed the feasibility of CCS applications. Faults and fracture networks can be major CO_2 escape pathways condemning the formation around the wellbore for successful CCS, see **Case 1**. Neighboring boreholes with induced fracture networks have been observed via VAS to present a similar risk for CO_2 loss. However, not every fault or fracture network represents a risk; VAS is able to assess which faults have participated in CO_2 loss, see **Case 2**.

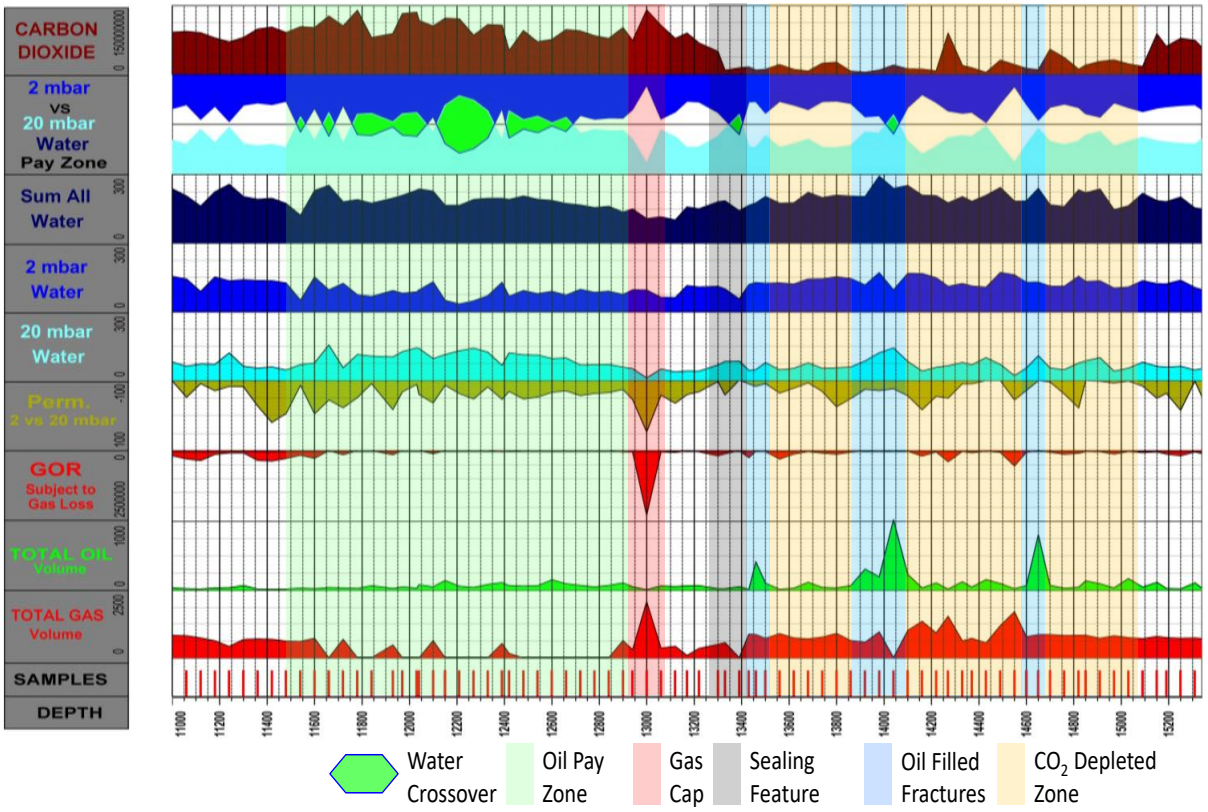
Sourcing of CO_2 Present in the Sub-Surface

VAS contains several signatures that provide insights into the sourcing of the CO_2 in the subsurface. CO_2 from biodegradation, high temperature breakdown of liquid HCs, and from underlying sour carbonate formations via fault/fracture network communication pathways have been identified by VAS. Information on the sourcing of the CO_2 in the subsurface can be critical to properly evaluating the utility of a formation for CCS as the presence of large pre-existing quantities of CO_2 in the subsurface could result in a formation or acreage being condemned for CCS when it may be due to localized phenomena.

Contact your Baker Hughes representative to learn more about how Volatiles Analysis Service can supplement your CCS reservoir characterization or visit www.bakerhughes.com

Volatiles Analysis Service (VAS):

Case Studies for Carbon Capture and Sequestration Applications



Case 1 (top): Hoxbar (Marchand Sand) lateral (SCOOP) drilled toe up. Production was ~30% of offset laterals. VAS water analysis (2 vs 20 mbar green crossover) suggests first third of lateral is in pay and then encounters a gas cap followed by a seal. Beyond seal the abundance of CO_2 is greatly reduced. Oil filled fracture swarms are detected in low CO_2 compartment. Oil was drained through fractures reducing overall pressure; CO_2 solubility is a function of pressure. In reduced pressure environment CO_2 came out of solution and escaped through fractures.

Case 2 (bottom): Ten mid-continent lateral wells in the Mississippian Lime across two counties were analyzed. Five that cross faults are shown. The laterals in black cross oil migrating faults, the lateral in yellow crosses a fault (red) that has allowed CO_2 to escape. Not all faults participate in CO_2 migration - VAS can identify when this occurs.