

## **Restored State Automated Shale Analysis**

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A new laboratory technique was developed to measure the shale desorption isotherms (the gas in place) without the use of specialized field laboratory. Due to high industry activity the field laboratories are not always available. The samples are retrieved from the well, preserved on location and then shipped to the laboratory. Upon arrival the gas saturations are restored and automated desorption isotherms are measured. These measurements are not affected by the lost gas calculation. These measurements can be used to validate lost gas calculations.

Also we developed a technique called "Residual Plus" to identify sweet gas zones by measuring the residual gas desorption isotherms. This measurement can be done in less than 12 hours and the results can be used for critical horizontal leg placement. This technique is also performed on shipped samples and does not involve a field laboratory.

The complete process of shale evaluation is described in detail. Several shale concepts we use are also described. The pore networks (reservoir quality) and the tight matrix (seal capacity) of the shale are defined using laboratory experiments. Pore interconnectivity is also quantified using the diffusion parameter ratio. The use of helium for free gas measurements is explained.

The proposed shale evaluation consists of automated desorption isotherms checked against sorption isotherms, micro fracture evaluation, tight rock analysis, diffusion parameter measurements, geochemical (TOC and Rock Evaluation, RoJ, x-ray diffraction, SEM, capillary suction time for fluid optimization, mercury injection capillary pressure and pore size distribution, acoustic velocity measurements and dynamic rock mechanics.

The very low matrix permeability, combined with the fast recovery offered by the rotary sidewall coring tool, makes the rotary sidewall samples best candidates for collecting quality desorption data. The small sample size makes it possible to get desorption much faster. A six month's full diameter desorption project can be performed in days using sidewall samples. This technology can accurately find the "sweet gas zone" before horizontal drilling begins.

A fast desorption prevents the errors associated with sample contamination by capillary imbibition, hydrogen generation by bacterial growth in the full diameter desorption canisters.

Our automated shale analysis techniques are cost effective and can concurrently test a large number of samples.