

CWLS Short Course

Multi-mineral Solvers

Instructors: John Quirein and Jim Witkowsky, Halliburton

Date: Oct 12th and 13th, 2010

Time: 8:00 a.m. - 4:00 p.m.

Place: Halliburton Training Center

Room 1830, 18th Floor

645 – 7th Ave SW

Fee: \$450 CDN To register call CWLS office 403-269-9366

The formation mineralogy is important for obtaining accurate porosity estimates in carbonates and also for shale gas reservoirs where unrecognized kerogen can result in erroneous porosity and hydrocarbon volume estimates. This course will focus on using wire-line geochemical data and multi-mineral solvers for obtaining mineralogy.

In particular, this short course will cover the fundamentals of the following topics: 1) Overview of available commercial well-log based multi-mineral solver applications, 2) Comparison of deterministic approaches and multi-mineral solvers, 3) Overview of optimization and non-linear solvers including sum of squares minimization, linear constraints, non-linear constraints, 4) response parameters and response equations linear by volume (ρ_b , U), linear by weight fraction (Al, Mg, Fe, Ca, Si, K), non-linear (Archie, dual water model, neutron logs), 5) Spreadsheet Solvers: Excel's built-in optimization tool called "solver", 6) Selection and validation of "mineral models" with cross-plots of the elementals (Al, Mg, Fe, Ca, Si, K, Th), reconstructed logs and core XRD and ICP data, 7) Results and model uncertainties, 8) multi-mineral solver examples and "live processing demos" from carbonates (Saudi), shale gas reservoirs (Haynesville) and unconventional reservoirs (Bakken Shale), and 9) recent technology developments including very thin bed Stochastic inversion, Bayesian inversion and simultaneous inversion of layered models.

Participants should bring their lap-tops with the EXCEL Tools → Add-Ins → Solver Add-in installed for some hands on familiarity with multi-mineral solvers. Three examples will be discussed and processed by participants: 1) Solving for mineral densities using core bulk density and XRD data; 2) Calibration of elemental mineral parameters from ICP and XRD data; 3) solving for mineral weight fractions from geochemical data.