Title:
DEC-3: “RhoVe Method – New Empirical Pore Pressure Transform”

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Submitted by:
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Business Impact:
- Rig safety, and the safety of all rig personnel are always the foremost business driver.
- Reduced NPT (non-productive time) with improved state-of-the-art pore pressure analysis and prediction capabilities.
- An immediate impact of the RhoVe method is that the density log is now in play as a pore pressure indicator (for both real-time and post-well analysis), which can be an important consideration when drilling unconventional reservoirs and other applications.
- Shale discriminated sonic and density data are transformed to common estimates of effective stress and pore pressure, where convergence of the two properties offers a robust solution,
- the potential to automate that portion of the pore pressure calculation (AI neural network capability) related to compositional changes.
- the RhoVe method provides a rationale for subdivision of major flow units and boundaries, which can be utilized in

basin modeling simulations and workflows; and the opportunity to finally (definitively) unite velocity-based methods with basin modeling approaches.

- notebook (iPad) capability: the addition of a virtual mouse-wheel is all that would be required to perform pore pressure analysis on-the-fly. Data conditioning (shale picking) would be performed on a desktop, or more likely automated.
- interactive, ease-of-use mouse-wheel functionality would make it ideal and much more approachable for potential users that are less than subject-matter experts.
- Ease-of-use interest by major operators looking for efficiency (cost savings) by including a dual-role for Ops Geologist to include pore pressure analysis for their RTOC's.

Technical Objectives

Commercial implementation of the RhoVe Method (web-based, or plug-in to existing platform(s)) to include:

- Real-Time WITSML connectivity,
- notebook (iPad) capability,
- interactive 1D temperature modeling,
- standard resistivity (Waxman-Smits) and Dx,
- Explore AI (artificial intelligence) neural network functional capabilities to work with the RhoVe method. In short, to investigate automation of pore pressure calculations related to compositional changes.
- unite velocity-based methods with basin modeling approaches.

Methodology:

There are no perceived technical hurdles; the technology already exists for all proposed applications. Software developers have already provided cost estimates, and are available to generate the software as a plug-in feature to existing G&G commercial platforms, or as a stand-alone web-based application.

The JIP can be initiated when the minimum critical funding level has been achieved. Minimum critical funding is defined as negotiated terms with a preferred software developer, who has agreed to full-or-partial funding. The initial phase of the JIP will be when sponsor, or multiple sponsors meet and agree on a preferred platform for commercialization.

A python script, based on RhoVe method is available for reference material, that was generated by Enthought, Inc. (Austin, TX) as a "proof of concept". All copyrights are owned by GCS Solutions, Inc.

Plans will be developed for follow on phases to organize a formal JIP.

Deliverables:

- Established workflows, best practices, co-ordinate training and tools
- Commercial implementation of the RhoVe Method (web-based, or plug-in to existing platform(s)) to include:
    - Real-Time WITSML connectivity,
    - notebook (iPad) capability,
    - automated/shale picking workflow,
    - interactive 1D temperature modeling,
    - standard resistivity transform (based on Waxman-Smits, that includes temperature and salinity corrections) and Dx,

- Feasibility study of AI (artificial intelligence) neural network functional capabilities to work with the RhoVe method, to investigate automation of pore pressure calculations related to compositional changes. If budget is sufficient, move forward with implementation.