

March 16, At the Borehole Scale Discussion Sessions

Horizontal Well Placement and Evaluation

Discussion Leader: Michael Bittar, Senior Director for Halliburton Technology

Challenges

- Rt
- Unknown structure
- Changing formation thickness
- Faults
- Changing formation properties
- Heterogeneities, e.g. laminations
- Pinchout

Proactive Tools for Geosteering

- Deep Azimuthal Resistivity for boundaries, fluid contacts – Need contrast in conductivity
- Acoustic – Shear for fractures, Compressive for porosity, Telemetry rate issues
- Seismic – Seismic at Bit, VSP – Practical Operationally?

Reactive Tools for Geosteering

- Nuclear
 - Neutron / Density(Pe) for porosity / lithology
 - Drillers objecting to running radioactive sources
 - Gamma Ray lithology indication
- Imaging
 - Resolution Issues
 - Sensitive to Drilling Dynamics
 - Telemetry rate issues
 - Large Hole Size affects dip computation
 - Tool Depth of Investigation affects dip computation
 - Resistivity – Affected by Mud Type
 - Density – No Mud affect
- Formation Pressure / Mobility Measurements
 - Tar Mats
 - Permeability indication
- NMR
 - Tar Mats
 - Bound water
 - Saturation
- Drill Cuttings
 - Lithology
 - Porosity Indication
 - Bio and Paleo Steering
- ROP
 - Dense versus Porous Zones
 - Hard versus Soft Formation

Surface Resources

- 3D Detailed Modeling

- People – Expertise
- RTO
- Quick Look Evaluation
- What if scenarios

Future Technology

- Look ahead of bit
 - 50 meters great
 - 100 meters excellent
- Integration of existing measurements
 - Resistivity
 - Gamma Ray
 - Acoustic
 - Sigma
- Improve telemetry rate to 1 Gbaud
- Bit Seismic
- Acoustic reflectivity
- At the Bit Sensors
- Better Dip calculations
- Reservoir illumination
 - Surface to tool, Tool to surface
- Delineate layering
 - Pe curve

Formation Evaluation (Section cut off due to time limitations)

- When selecting tools need to be aware of the formation evaluation issues.
- Take shallowest resistivity unaffected by invasion for RT