CANADIAN WELL LOGGING SOCIETY

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Wednesday, May 13th, 2009
CWLS TECHNICAL LUNCHEON PRESENTATION
FAIRMONT PALLISER HOTEL
133, 9TH AVE. S.W. CALGARY

TIME: 12:00 PM (COCKTAILS AT 11:30 AM)

RESERVATIONS BY: Friday, May 8th, 2009 (NOON) - CALL 269-9366 TO CONFIRM A SEAT

COST: MEMBERS RESERVED MEAL: $35.00; NON-MEMBERS RESERVED MEAL: $40.00
(SPECIAL NEEDS MEALS AVAILABLE WITH ADVANCED BOOKING ONLY; PLEASE REQUEST WHEN ORDERING TICKET)

TOPIC: **The state of fluid saturation in tight-gas reservoirs: Insights and implications from the Rocky Mountain basins.**

SPEAKER: Keith Shanley, Geologist, Discovery Group, CO.

ABSTRACT:

Log analysis techniques attempt to discern the relative proportions of formation water and hydrocarbons within reservoir rocks in the hopes of guiding completion decisions, aiding in volumetric assessments of hydrocarbons, and deciphering production trends. In most conventional petroleum provinces there are close correlations between log calculated water saturations, hydrocarbon producibility, and hydrocarbon column height. In most tight-gas basins, however, these relationships do not evident.

Implicit to the interpretation of water saturation and hydrocarbon productivity is the assumption that the reservoirs are in a state of primary drainage equilibrium with respect to capillary pressure. We find that in many tight-gas fields and adjacent non-productive wells there are inconsistent relationships between saturation and height, productivity, and water production. Water saturation-height trends often differ by little more than 5-10 points from top to bottom of a reservoir interval, in some cases over several thousand feet, and we rarely observe truly high water saturations associated with water-bearing intervals. Log calculations in many waterbearing zones imply significant hydrocarbon saturation. Likewise, capillary-pressure curves provide little assistance in terms of predicting fluid distribution and petrophysical rock-typing often yields conflicting insights to performance. Because of these poor relationships it has been suggested that calculated water saturations must be in error due to incorrect electrical parameters, errors in water resistivities, excess conductivity due to clays, etc. Implicitly, if we just had the 'right' parameters or used the correct model, we could better describe the saturation state of the subsurface and achieve a better correlation to production.

Perhaps the fundamental problem lies not in our choice of saturation model or the various parameters required, perhaps the fundamental problem lies in the assumption that tight gas reservoirs are in primary drainage equilibrium with respect to capillary pressure. Basin history models suggest reservoirs and fields were charged with hydrocarbons when porosities

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Notes: Please forward this notice to any potentially interested co-workers. Thank you.

were greater, perhaps by a factor of 2, and permeabilities were much greater, perhaps by a factor of 10 – 1000 times, the values found today. This initial charge was likely a drainage capillary process. During subsequent uplift and structural reorganization, many (most?) reservoirs departed from their primary drainage equilibrium state and are better described by a state of imbibition (primary or higher) or a state of secondary (or higher) drainage equilibrium. Outside of trap geometries, many reservoir intervals approach residual gas saturation as a result of gas re-migration and trap-reorientation. Residual gas saturation is largely controlled by initial saturation and pore geometry and may vary from approximately 25% Sw to as much as 80% Sw. As a result, it becomes extremely difficult to distinguish near residual gas saturation from saturations associated with economically attractive gas columns. The key to improving tight-gas formation evaluation is understanding and recognizing the geologic history that leads to a non-primary drainage equilibrium state and developing new methods to identify residual (near residual) saturation.

BIOGRAPHY

Keith W. Shanley is a consulting geologist with the Discovery Group in Denver, Colorado with almost 30 years of experience in petroleum exploration, development, and research. He has worked in a variety of basins around the world for both major and independent oil and gas companies. Keith's professional background was initially established in the fields of sedimentology, sequence stratigraphy, in particular as applied to shallow marine and non-marine strata. In that arena he has published numerous papers, edited volumes, and organized conferences and seminars. In the last few years
Keith has expanded his interests to include tight-gas resources and petrophysics. His research interests include sequence stratigraphy and reservoir architecture, the integration of petrophysics, risk analysis and unconventional hydrocarbon resources.

In 2004 Keith co-edited an AAPG Studies in Geology volume (Studies #52) dealing with Jonah Field and in 2005 Keith was a co-convenor of the Vail Tight Gas Hedberg Conference. The results of the Hedberg conference were recently published by the AAPG (Hedberg series #3). Keith's work on tight-gas resources has been recognized by the American Association of Petroleum Geologiststs which awarded him and his coauthors the 2006 Pratt Award for best paper, and by the Canadian Society of Petroleum Geologists which awarded them the 2005 Medal of Merit for the most significant paper pertaining to the petroleum geology of Canada.