AEROMAGNETIC DEFINITION OF BASEMENT LINEARS AND THEIR INFLUENCE ON DEPOSITIONAL PATTERNS AND HYDROCARBON ENTRAPMENT IN THE GREATER GREEN RIVER BASIN

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ABSTRACT

Structurally and stratigraphically entrapped hydrocarbons, as well as the trends of reservoir facies and hydrocarbon migration pathways in the Greater Green River basin are influenced strongly by basement linears. At least three types of basement structural features influence production: 1) basement structural highs; 2) short basement faults that commonly define the margins of basement structural highs; and 3) regional crosscutting linear features that define and create major structural and compositional discontinuities. These three types of structural features are recognized and interpreted from patterns observed on the Second Vertical Derivative and SUNMAG displays of aeromagnetic data, as well as structures defined by line profile analysis. Integration of these data with log, facies, hydrocarbon show, and production information indicate that motion along regional basement linears is instrumental in controlling where entrapment of hydrocarbons takes place.

Many of the depositional patterns and their associated reservoir facies of producing formations in the Greater Green River basin, show a direct relationship to the juncture of basement structural highs with crosscutting regional linears, or to other linear features orthogonal to regional features. Major northwest-oriented regional basement linears controlled the distribution and orientation of Dakota and Muddy lowstand valley-fill deposits in the western part of the Greater Green River basin, while orthogonal northeast linears controlled the orientation and distribution of reservoir facies in associated shoreline deposits.

Basement linears developed a northwest-northeast orthogonal pattern in the area of the Moxa arch. During the Late Mid-Turonian sea-level drop, fluvial valleys formed a rectilinear drainage pattern. The fluvial valleys that incised the lowstand surface followed the subtle topography created by differential movements of orthogonal-shaped basement blocks. The streams incised into more easily eroded fractured margins of the blocks. Frontier formation valley-fill reservoir facies accumulated in the orthogonally oriented valleys that developed during the Late Mid-Turonian sea-level lowstand. Production trends from these valley-fill deposits directly reflect the orthogonal depositional patterns resulting from the influence of the basement linears.

In the Upper Cretaceous Almond formation, in the eastern portion of the Greater Green River basin, basement linears have affected the distribution of reservoir facies. The Almond formation accumulated as retrogradational shoreline deposits during a period of rising sea level. Because of the transgressive nature of these deposits, much of the potential upper shoreface reservoir facies was stripped during the transgression. The thickest and best quality reservoir deposits accumulated as inlet fills associated with the retrogradational shorelines. The main reservoir facies at Echo Springs field is in inlet-fill deposits. A major northwest-southeast oriented basement linear controls the southern limit of the inlet-fill reservoir facies in the Echo Springs field.

In the Greater Green River basin, production commonly ends abruptly, or changes trend, at basement linear discontinuities. Consequently, these linears appear to be critical in controlling not only structural development, but also the productive limits of many stratigraphic entrapments. These limits may occur due to diagenetic alterations or to

changes in facies. In either case, these relationships indicate that basement linears were active during deposition or influenced diagenetic fluid movement through the reservoir system at a later time in the Greater Green River basin.

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AN INTEGRATED ANALYSIS OF THE MADISON FORMATION: MADDEN FIELD, FREMONT COUNTY, WYOMING

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ABSTRACT

The ultra deep and ultra expensive drilling occurring in the Madden field of the Wind River basin commands a lot of preparation and analysis. This 25,000-foot reservoir possesses multiple trillion cubic feet capabilities from no less than four wellbores to as many as 11. Daily production rates per wellbore range from 40 to 50 MMCF. These rates are constrained due to processing capacity. Wells are capable of substantially higher rates since calculated Absolute Open Flows of more than 150 MMCF have been recorded.

The gas being produced is extremely sour and dirty. The hydrogen sulfide content hovers around 12% and is coupled with a carbon dioxide content of 21%. This leaves a hydrocarbon content of only 67%, which is basically all methane. Expensive gas plant facilities are required to treat and process this gas. The current daily inlet volume is 130 MMCF but construction is underway to increase this to 310 MMCF at a cost of about 1.5 MM$ per million cubic feet.

The productive reservoir is fractured, dolomitized limestone situated on an immense structural closure. The structural closure is bounded on all sides by thrust faults with vertical displacements as high as 5,000'. A gas column at least 1,200' thick has been proven.

The justification of this project has been achieved through thorough investigation of the geology, geophysics, and reservoir engineering. The latest technologies have been employed to maximize success. Risk analysis, reservoir simulation, three dimensional seismic interpretation, core analysis, outcrop analysis, and subsurface e-log analysis are the tools that have been utilized to generate a collective evaluation of this world class gas reserve.

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