

fields that fit historical field-size patterns similar to those established in both plays during the past 10 years.

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#### Relationship of Cretaceous Synorogenic Conglomerate in Central Utah to Sevier Thrust Events

A boulder conglomerate facies is found almost continuously along the western edge of the Cretaceous seaway in central and southern Utah. At the present time, north-south continuity of the facies is disrupted by Tertiary volcanic cover and basin and range-type faulting, making the original distribution of conglomerate difficult to follow.

Careful physical comparison of good conglomerate exposures and developing palynologic control in fine-grained equivalent sediments to the east allows some correlation of the facies trend and indicates a close time relationship with Sevier thrust events. Silicic and carbonate boulder conglomerates were limited to a relatively narrow east-west zone directly in front of the leading thrust edge. Rapid eastward transition to well-sorted sand and coastal marine conditions suggests deposition relatively close to base level.

Major unconformities within the conglomerate sequence and the upper and lower limits of coarse clastic sedimentation define several depositional episodes. It appears that the conglomerate packages are related to specific Sevier orogenic events.

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#### Changing Exploration Concepts in Arapien Basin, Central Hinge Line, Utah

The Arapien basin is situated along the hinge line in central Utah between the Wasatch Plateau to the east and the Canyon and Pavant Ranges to the west. The basin was initially described from the extensive exposure of Jurassic shale and evaporites in the Arapien Valley. Subsequent drilling and seismic profiling revealed thick zones of structurally complex strata beneath the ranges and great depths of sediment fill in the central valleys.

The concept of the Arapien basin and consequent exploration strategies are dependent on how the sequence and importance of structural events in central Utah are envisioned. New ideas include: (1) the concept of stratigraphic thickening from shelf to miogeosyncline across the hinge line includes the Arapien basin as a partially enclosed, graben-type basin subject to desiccation and evaporative deposition, (2) the concept of salt diapirism and salt solution collapse, which has figured prominently in the thinking of some recent workers, (3) the full acceptance of Sevier thrusting, which brings into focus the uniform timing of compressional events in central Utah and thickening of strata by tectonic duplication, and (4) the concept of basin and range extension which is now accepted by many geologists. The reality of listric block faulting and back sliding explains the tilted Tertiary strata on the ranges and the anomalously thick strata in the valleys.

Sorting out the sequence of structural events in the Central Utah hinge line is clearly needed to formulate exploration strategies in the Arapien basin. The abundance of shows in the Wasatch Plateau and the projected extension of overthrust structures south into the area warrant continued interest.

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#### Generation of Depositional Facies Maps Using Microcomputers and Lithocrossplot Data, Minnelusa Formation, Powder River Basin

A series of depositional facies maps for units within the upper member of the Permo-Pennsylvanian Minnelusa Formation was generated using data from core descriptions and geophysical logs in combination with regional isopach maps. Over 1,300 ft (396 m) of described core from 22 wells was used to "calibrate" log readings to the four principal lithologies: anhydrite, dolomite, cross-bedded sandstone, and wavy-bedded sandstone. Log cutoff values for each lithology were derived from core through graphic and statistical analysis using standard cross-

plots. Over 24,000 ft (7,315 m) of "synthetic" core was generated for 121 uncored wells. Data were analyzed with microcomputers using common software such as LOTUS 1-2-3 and dBASEII. Clastic and carbonate percent maps were made using all 143 control points. Lithofacies work maps were then constructed by overlaying clastic and carbonate percent maps with regional isopachs. Facies interpretations, based on sedimentary features observed in core, were extrapolated to the lithologic sequences in the "synthetic" cores. These interpretations served as environmental constraints in the construction of the final facies maps.

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#### Seismic Exploration for Oil and Gas Traps in Wind River Basin: a Laramide Example

The Wind River basin in central Wyoming is typical of the large sedimentary and structural basins that formed in the Rocky Mountain region during Laramide deformation in latest Cretaceous and early Tertiary times. Northeast-southwest-oriented seismic profiles across the Wind River basin and flanking Owl Creek and Bighorn Mountains illustrate the structural configuration and correspondent stratigraphic development of a typical Laramide intermontane basin. Understanding the geometry of the basin margin and the timing of structural movement aids in prospecting for mountain-front subthrust structures, like Tepee Flats field, and stratigraphic traps, like Haybarn field, in fluvial and lacustrine basin-fill sequences.

The Wind River basin is structurally asymmetric with the basin axis close to the Owl Creek Mountains and Casper Arch thrusts, which form the north and east basin boundaries. Major Laramide deformation began in latest Cretaceous time (beginning of Lance Formation deposition) with pronounced downwarping of the basin trough and broad doming of parts of the peripheral areas. The intensity of movement increased through the Paleocene and culminated in early Eocene time as high mountains were uplifted along thrust faults. Clastic debris, stripped from the surrounding rising mountain arches, was shed basinward, resulting in a pronounced wedge-shaped accumulation of fluvial and lacustrine sediments now representing the Lance, Fort Union, Indian Meadows, and Wind River Formations.

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#### Comparison of Hydrocarbon Production Trends in Middle and Upper Members of Minnelusa Formation

The main reservoir rocks in the upper and middle members of the Minnelusa Formation consist of windblown dunal sands in the area surrounding the Lusk embayment. Changes in the local depositional setting, tectonic framework, and eustatic sea level controlled the distribution and reservoir quality of these sandstones. An understanding of the lateral and vertical variations within and between these members explains the different production trends and may be utilized to formulate predictive models to aid in the development of future exploration programs.

The middle member exhibits two production trends. Age-equivalent Tensleep rocks deposited along the western margin of the embayment produce from sandstones accumulated in a sand sea paleoenvironment. Structure is necessary for trapping owing to permeability continuity. Along the eastern margin of the embayment, production comes from isolated accumulations of sandstone deposited as dunes on broad coastal sabkhas. Fields in these sandstones define a linear trend due to the coast-parallel alignment of these dunes.

Production from the upper member defines four major trends. Upper member sandstones in the southern part of the basin, similar to "Leo" reservoirs, produce from sediments deposited as coast-parallel dunes in a northwest-southeast alignment. In the northern portion of the basin, production is from sandstones deposited in broad, flat eolian sand seas. Because of the permeability continuity of these sandstones, structural closure is necessary for trapping hydrocarbons.

Upper member production has been influenced by the unconformity developed at the top of the Minnelusa. Movement along the Rosebud arch resulted in a southwest-northeast production trend apparent in each sandstone unit reflecting their northwestward erosional limits. The last,