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Use of Gamma-Ray Log for Locating Cretaceous-Tertiary Unconformity, Pinedale Area, Northern Green River Basin, Wyoming

Computer-generated crossplots of the gamma-ray log versus depth in the Pinedale area, northern Green River basin, Wyoming, exhibit an abrupt shift in API gamma units over the structurally influenced depth range of 7,100-8,500 ft (2,100-2,600 m). Higher API units are recorded for all lower Tertiary rocks than for underlying Upper Cretaceous rocks. The shift, which is not obvious from viewing analog prints, coincides with the Cretaceous-Tertiary boundary as located in this area by previous workers using different methods.

Evaluation of gamma-ray spectral logs from five wells, combined with petrographic and x-ray diffraction analysis of core samples from the Pinedale area, shows that this shift is caused by a higher potassium content in Tertiary rocks than in Cretaceous rocks, due to the presence of arkosic sandstones. Within the lowermost 600 ft (180 m) of the Tertiary, the potassium feldspar content of the sandstones gradually decreases with depth down to the Tertiary unconformity and then abruptly declines, essentially to zero, in the Cretaceous.

Crossplots of gamma-ray intensity versus depth from other wells in the northern Green River basin show a diminution of this shift to the west and southwest of the Pinedale area. This relation suggests that the Precambrian crystalline core of the Wind River Range, which was upthrust and eroded during the Laramide orogeny, provided the source of the arkosic Tertiary sandstones.

In many Rocky Mountain basins, identification of the Cretaceous-Tertiary boundary is problematical due, in part, to the similar lithology and depositional environments of the nonmarine rocks as well as to the absence of outcrops and reliable biostratigraphic data. The approach described may be applicable to other areas.

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Exploration Planning in 1980s—Methods, Techniques, and Philosophy

The business environment, within which the oil exploration business will be forced to operate during the 1980s, will require exploration management to evaluate their investment opportunities in light of economic conditions and in conjunction with their companies' business strategies. To do so will require techniques and methods to analyze future field sizes, risks, and potential rewards. Proposed methods will allow construction of a series of portfolios of future investment opportunities that will permit a selective process for resource allocation for exploration. Various exploration strategies can then be tested by computer modeling to ascertain the exploration strategies that will be compatible with their companies' business planning and strategies.

Although the planning concept was designed primarily for the oil exploration business, methods, techniques, and concepts can be carried over to other energy mineral exploration.

In this present environment it is also necessary that explorationists understand how their efforts may be integrated into the total exploration program so they will not expend unnecessary time on prospects that will not fit into their companies' overall strategies.

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Hydrothermal Uranium Vein Deposits in Marysvale Volcanic Field, Utah

Hydrothermal uranium veins are exposed over a 300 m (980 ft) vertical range in mines of the Central Mining area, near Marysvale, Utah. They cut 23 Ma quartz monzonite, 21 Ma granite, and 19 Ma rhyolite ash-flow tuff. The veins formed 18-19 Ma, in an area 1 km (0.6 mi) across, above the center of a composite magma chamber at least 12 × 6 km across that fed a sequence of 21-14 Ma hypabyssal granitic stocks, and rhyolitic lava flows, ash-flow tuffs, and volcanic domes. Intrusive pressure uplifted and fractured the roof; molybdenite-bearing, uranium-rich, glassy dikes were intruded; and a breccia pipe and uranium-bearing veins were formed.

The veins appear to have been deposited near the surface above a concealed rhyolite stock, where they filled high-angle fault zones and flat-lying to concave-downward "pull-apart" fractures. Low pH and fO_2 hydrothermal fluids at temperatures near 200°C (392°F) permeated the fractured rocks; these fluids were rich in fluorine and potassium, and contained uranium as uranous-fluoride complexes. Fluid-wall rock interaction increased fluid pH, causing precipitation of uranium minerals. At the deepest exposed levels, wall rocks were altered to kaolinite and sericite, and uraninite, coffinite, jordisite, fluorite, molybdenite, quartz, and pyrite (with $\delta^{34}S$ near zero per mil) were deposited. The fluids were progressively oxidized higher in the system; iron in the wall rocks was oxidized to hematite, and sooty uraninite and umohoite were deposited.

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Relationship Between Reflectivity and Organic Sulfur Content of Macerals with Respect to Total Organic Sulfur Content and Rank of Coals

The potential exists for predicting organic sulfur (S_o) contents of specific macerals within a coal based on total S_o content of the coal, rank of the coal, and maximum reflectivity in oil (R_o) of the macerals in question. In the past, determination of S_o content of specific macerals necessitated either a microanalysis technique, such as electron probe microanalysis (EPM), or analysis of maceral separates. Ten coal samples ranging in rank from low volatile to lignite and total S_o content from 0.47 to 4.51 wt. % were studied. Within each of the 10 coals, approximately 100 macerals ranging from the lowest reflecting exinites to the highest reflecting inertinites were analyzed for S_o content (using EPM techniques) and R_o (using petrographic techniques). For each coal, log of maceral S_o content was plotted versus log of maceral R_o, and a linear regression of the data points was performed. On a three-dimensional plot, slopes of the 10 linear regressions were plotted versus the respective coal ranks versus the respective coal total S_o contents. Results indicate that relationships between S_o content and R_o of macerals within a coal are dependent on both the rank and total S_o content of the coal. As total S_o content of a coal equals S_o content of the vitrinite in that coal, the results suggest that predictive relationships exist between maceral S_o content, maceral R_o, coal total S_o content, and coal rank that may allow determination of maceral S_o contents without the need for microanalysis.

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Tectonic Analysis of Belt Terrane of Northwest Montana–Northern Idaho and Its Implications for Oil and Gas Potential West of Disturbed Belt

From a recently completed comprehensive regional geologic map and cross sections across the Cordillera of the northwestern United States, the following conclusions have been made. (1) Paleozoic as well as probable late Precambrian Belt miogeoclinal sedimentation developed west of northern Idaho off the edge of the continental crust. Present position of the thick sediment wedge thereby suggests 100-200 km (62-124 mi) of eastward displacement on a passively involved cratonic basement. (2) Mesozoic orogeny started west of the continent margin, shifted east, and did not involve the Disturbed belt until earliest Tertiary time. Thus, a significant time span separated mobility and uplift in the core region of the orogene from thrusting of the foreland. Continental subduction (underthrusting) beneath the uplifted and "cold" core is a probable explanation for the great shortening during the Laramide orogeny. (3) Immediately following thrusting, the entire northwest was swept by a 40-50 m.y. extensional orogeny involving, from place to place, widespread calc-alkaline magmatism, listric faulting on a grand scale, subhorizontal detachment faults, and basement mylonitization. This tectonism influenced the Belt region by fragmentation and eastward tilting of strata and thrusts, and creation of structural relief on the pre-Belt basement surface by normal faulting. A less obvious and speculative effect may be ductile mylonitization in the basement, as is exposed in the metamorphic core