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Heat-Flow Study of Snake River Plain, Idaho

A heat-flow study of the Snake River Plain is in progress to evaluate the geothermal potential and provide constraints for regional geotectonic interpretation of the plain. Heat-flow data have been obtained from over 100 water wells, thirteen 100-ft (31.1 m) holes drilled specifically for this study along two north-south profiles across the western part of the plain, and two 500-ft (155.5 m) bore holes in the Idaho batholith at the northern end of the profiles. Observed geothermal gradients range from 40°C/km to more than 150°C/km and observed heat-flow values range from 2.3 to over 4.5 ucal/sq cm sec. Preliminary results show anomalous heat-flow values (greater than 2.5 ucal/sq cm sec) over large areas of the plain.

Thus the preliminary results indicate the regional heat flow of the Snake River Plain is above the average of regions of high heat flow of the western United States. Differentiation of the heat transfer due to regional aquifer systems and that due to crustal and mantle heat sources is still uncertain; however, the heat-flow data provide constraints for the evaluation of aquifer systems and on the mode of the formation of the plain. Preliminary conclusions are that the crustal and/or mantle component of heat flow must be higher than the surrounding areas of the northern Rocky Mountains and the Basin and Range province and that large areas of the plain have significant geothermal potential.

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Uranium in Tertiary Channels Southeast of Lake Frome, South Australia

Lower Tertiary fluvial paleochannels incised in older rocks are present over a wide area of the southern Frome embayment, South Australia. The buried channels contain similar stratigraphic sequences of interbedded sands, silts, and clays, probably derived from an adjacent uranium-rich Precambrian province. Uranium mineralization is pervasive within two paleochannels. Four small uranium deposits have been found in the basal sand of these channel sequences at the margin of extensive tongues of limonitic stained sand. A geochemical zonation reflected by variations in limonite, pyrite, carbon, and humic material is defined across one of these deposits. A genetic model is proposed suggesting formation by a uraniferous geochemical cell which migrated down the paleostream-channel gradient and concentrated uranium along its lateral margin adjacent to the channel bank.

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Variations in Natural Gas Composition in Blanco Field, San Juan Basin, Related to Source-Rock Type, Thermal Maturity, and Migration

This investigation was undertaken to determine the feasibility of utilizing published gas analyses to aid in reconstructing a basin's hydrocarbon generation and migration history. Results show that the most useful index available is the ratio of the methane concentration to the total hydrocarbon concentration, which is simply a measure of dryness. Methane ratios of natural gas produced from the San Juan basin were mapped by stratigraphic interval and then compared to known thermal-maturity patterns in the basin. The methane-ratio maps of each Cretaceous producing zone showed an orderly increase in concentration toward the north or basin center, corresponding to thermal maturity. The only exception to this pattern is in part of the Pictured Cliffs accumulation where gas in the southern part of the field increases in dryness southward in the direction of lower thermal maturity, possibly reflecting gas of predominantly biogenic origin. Pennsylvanian methane ratios exhibit a much more scattered pattern and there is no distinct relation to thermal maturity.

It is concluded that most Cretaceous gas in the Blanco field is trapped in situ by stratigraphic and/or hydrodynamic trapping and at each point reflects its source-rock type and level of thermal maturity by its particular composition. In contrast, Pennsylvanian gas appears to be "mixed" by lateral migration into structural traps. Also, the source for the Pictured Cliffs and Mesa Verde gases is concluded to be predominantly humic organic matter. Dakota gases, on the other hand, appear to have been generated from predominantly sapropelic organic matter, because the level of thermal maturity associated with dry gas is much higher than in the Pictured Cliffs and Mesa Verde source rocks. Known sediment facies of the Dakota, which is interbedded with and overlain by marine shales, and Pictured Cliffs and Mesa Verde, which is dominated by coaly coastal-plain sediments, support this conclusion.

In summary, gas compositions may be useful to aid in determining the source relations, thermal maturity, and migration history of a basin. This not only helps to explain existing production, but also may hold important implications regarding the exploration potential of the undeveloped basin area. In particular, the San Juan basin serves as a classic example of how gas compositions are dependent on source-rock type and its stage of thermal maturity. It is also an excellent illustration of the voluminous gas reserves that must have been generated thermally in other western Rocky Mountain basins with similar sediment facies relations and temperature histories.

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Structural Geology and Petroleum Potential of South Flank of Uinta Mountain Uplift

The north flank of the Uinta Mountains has a well understood upthrust structural style. Field investigations show that upthrust faults also occur within the range near the Utah-Colorado border. However, the major exposed structures on the south flank (South Flank fault zone) have normal configuration.

Seismic surveys and exploratory wells show that the south flank of the Uinta Mountains also is bounded by an upthrust fault system, which is completely masked by Tertiary sediments. The main mass of the Uinta