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Radon and Hydrocarbons in Soil Gases of Northeast Ohio

Radon survey techniques are being used to determine whether significant variations of Rn^{222} content occur in soil gases of northeastern Ohio and, if so, whether they have hydrocarbon prospecting potential. Radon activities are determined by using electronic detectors for short-term variations and film cups for long-term variations.

Preliminary traverses covered more than 300 sites. Three localities were found in which the radon activities are reproducibly higher than regional "background" by a factor of 5 to 10. One case correlates with proximity to the outcrop belt of the uranium-rich Huron Member of Ohio Shale. The others consist of localized anomalies not directly associated with uranium-rich shales. Laboratory experiments of soil samples showed radon in anomalous regions is not produced in situ within the upper 1 to 2 ft (0.3 to 0.6 m) of soil, suggesting a deeper origin for migration of radon to near-surface soil gas.

Occasional localized seeps of natural gas occur in northeastern Ohio. Light hydrocarbons C_1 to C_3 are usually associated with reducing environments causing precipitation of uranium and its products at shallow depths which could conceivably enhance radon activity at the surface. Also, hydrocarbons migrating upward from deeper sources would carry radon to the surface along more permeable and fractured rocks and create a radon anomaly. Light hydrocarbon analyses of shallow soil gases showed greater total hydrocarbon contents and greater C_2/C_1 and C_2/C_3 ratios in areas of higher radon activities. Measurements of hydrocarbons at greater soil depth, coupled with additional radon measurements, are in progress to interpret further the significance of radon-survey data.

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Austin Chalk Exploration

"Do you have such an objective in your own backyard?"

Since the "energy crunch" of the past few years, the incentive for domestic oil has led to exploitation of the Austin Chalk reserves. These areas have long been known, poorly understood, and sporadically utilized.

Exploration, completion, logging, and production techniques for these type reservoirs have been neglected, ignored, and "bad-mouthed" by the oil fraternity in general. Preference has been given to the mechanical log porosity types found high on structure in closure areas. While recognition of the fact that some of the earliest long-lived production (since 1870) has been from synclinal regional structure, the presence of shale or brittle limestone as reservoir rock types has been ignored.

Many young geologists and engineers are not cognizant of the possibility that commercial oil may exist in such traps or that they are worth exploring for. The rocks themselves must be examined for clues to their existence and this is considered old-fashioned and out of date by many.

Three major geologic controls and many man-induced techniques influence successful exploration for Austin Chalk and similar type oil accumulations. These geologic controls include (1) stratigraphic interplay of diverse facies types, (2) source-bed existence and maturation, and (3) tectonism for both maturation and fracture permeability development in potential reservoir rocks. All three of these geologic factors are interrelated and at times almost inseparable in importance.

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Paleomagnetic Methods for Orientation of Borehole Cores, Horizon Cleveland Field, Ochiltree County, Texas

Paleomagnetism provides a powerful tool for initially determining or verifying the compass orientation and top direction of conventional borehole cores from the Mid-Continent region. This is demonstrated by a study of four fully oriented diamond cores of Pennsylvanian fine-grained sandstone and siltstone taken to determine the orientation of a system of vertical fractures thought to control production in the Horizon Cleveland field, Ochiltree County, Texas. Although fractures in one of the cores were aligned 50 to 60° counterclockwise from the fractures in the other cores, suggesting the presence of two fracture directions in the field, paleomagnetic data show clearly that the core with anomalous fracture directions was improperly oriented and only one major system of vertical fractures exists. After "cleaning" by partial alternating field demagnetization, the mean directions of remanent magnetization for cores having consistent fracture orientations agree within $\pm 6°$ with the expected direction of orientation, based on the known average Pennsylvanian pole position for the North American craton, which confirms the correct orientation of these cores. The mean direction of remanent magnetization for the anomalous core, however, deviates about 60° counterclockwise from the expected direction proving that the core is misoriented.

Progressive partial alternating field and thermal demagnetization studies isolate and remove from nearly all the samples a strong magnetic component oriented vertically downward that partially overprints the original remanent magnetization direction. This overprint, resulting from a vertical magnetic field produced by the drill pipe and core barrel, was used to determine that several samples had been inadvertently placed in the core box upside down.

Paleomagnetic core orientation techniques should be generally applicable in the Mid-Continent and other regions with relatively uncomplicated geologic structure located on crustal plates for which paleomagnetic polar wandering curves are well established.

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Depositional Environment and Reservoir Morphology of Canyon Sandstones, Central Midland Basin, Texas

Canyon sandstones in the Midland basin were originally thought to be part of the Canyon Group, but are actually downdip equivalents of fluvial and deltaic sandstones in the Cisco and Wolfcamp Groups. The repetitive, ordered sequence of sedimentary structures and the texture and composition of these basinal sandstones indicate that they are deposited by turbidity currents.

Canyon sandstones were deposited as constructive turbidite channels. Bedset associations and reservoir morphology of constructive turbidite channels exhibit changes from upper-fan channels at Jameson field to middle-fan channels at Rock Pen field and to distal-fan channels and interchannel areas at Burnt Rock field. The upper-fan channels at Jameson field are commonly more than 50 ft (15 m) thick and consist of incomplete "AE" bedsets up to 6 ft (2 m) thick. The middle-fan channel at Rock Pen field averages 30 ft (9 m) thick, but displays similar incomplete "AE" sequences up to 3 ft (1 m) thick. Distal channels are thinner, have limited lateral extent compared to upper- and middle-fan channels, and consist of better