ABSTRACTS

REGIONAL PENNSYLVANIAN AND PERMIAN TECTONIC MOVEMENTS AND THEIR EFFECT ON CORRELATION OF UPPER PALEOZOIC STRATA IN THE POWDER RIVER BASIN AND BLACK HILLS

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Late Paleozoic tectonic movements greatly complicated patterns of deposition and preservation of Pennsylvanian and Permian strata on the eastern part of the Wyoming shelf. These localized movements coincided with development of the ancestral Rocky Mountains in Colorado and adjacent areas and of the Big Snowy trough in central Montana. Isopachs for the rock interval between the top of the Mississippian carbonate rocks (Madison Limestone and Pahasapa Limestone) and the base of the Permian Minnekahta Limestone in eastern Wyoming are deceptively uniform, suggesting late Paleozoic stability of the shelf. The regional structural pattern seems to have been dominated by an orthogonal system of faults that bounded rectangular blocks of terrain that were complexly and alternately elevated, depressed, or tilted relative to each other. Topographic relief on the shelf during the late Paleozoic was minor compared to the relief that has developed since the Late Cretaceous to Early Tertiary Laramide orogeny, but tectonic activity seems to have been greater during the Pennsylvanian than at any other time during the Phanerozoic prior to the Laramide.

The depositional environments and the total thickness of the Pennsylvanian and Lower Permian Minnelusa Formation were essentially uniform throughout eastern Wyoming. However, the formation comprises three unconformity-bounded members that are lithologically similar but are not uniformly thick owing to the differential movements, to penecontemporaneous erosion, and to compensating depositional infilling. Consequently, correlation of the members of the Minnelusa and individual strata within the formation is complicated by their lithologic similarities and their thickness differences.

Unconformities and significant changes in depositional patterns show the shelf was tectonically disturbed several times during the late Paleozoic: (1) in Meramecian (Late Mississippian) time, (2) at the onset of Pennsylvanian deposition, (3) about late Atokan to early Des Moinesian (Middle Pennsylvanian) time, (4) at the onset of Permian deposition, (5) during late Early Permian, prior to deposition of the Goose Egg Formation, and (6) during late Late Permian time before Triassic deposition began.

APPLICATIONS OF SURFACE GEOCHEMICAL TECHNIQUES FOR MAPPING METHANE ASSOCIATED WITH NEAR-SURFACE COAL DEPOSITS

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Results of a localized soil-gas survey conducted in the Rawhide Subdivision near Gillette, Wyoming, revealed areas where the concentrations of coal-sourced methane gas approached 1 million parts per million (100%). A map was produced that accurately displayed the areas in the subdivision where concentrations of methane gas in the vadose zone are higher than normal (background) and thus possibly hazardous to human activity.

Along the eastern edge of the Powder River Basin where Cretaceous coal deposits crop out or are near the surface, elevated concentrations of methane gas can be expected. Generally, the methane is contained by the coal or porous strata directly above the coal by a combination of overburden and groundwater pressure. Small and somewhat normal amounts of methane constantly escape to the surface even during stable conditions.

Abrupt changes (natural or man-made) of the delicate balance between overlying pressure and underlying gas concentrations can release large volumes of methane gas that migrate to the surface. Buildings (homes, schools, factory's etc.) that directly overlie these escaping gasses may act as collection centers for the methane and thus become health hazards.

The techniques used to map the methane concentrations in the Rawhide Subdivision can be utilized along the eastern Powder River Basin coal belt to more regionally identify variations in methane concentrations. This information would be helpful in;

1) future exploration programs (mapping)

2) identifying areas with already high methane concentrations (environmental)

3) preventing future poorly located housing developments (zoning)

4) monitoring present activity (mining)

5) mitigating existing problem areas (remedial)