the future by exploring in those areas more favorable to the accumulation of oil in primary traps that have not been modified greatly by Laramide folding. Oil initially in place may retard secondary silicification of the Tensleep sandstones.

23. STANLEY M. EDWARDS, Continental Oil Company, Casper Wyoming

PERMO-PENNSYLVANIAN OIL TRAPS OF WESTERN POWDER RIVER BASIN OF WYOMING

Most oil traps on the western flank of the Powder River basin at first glance appear to be the result of Laramide anticlinal flexures. This, however, is not true of the fields producing from the Minnelusa Formation. Several Laramide anticlines have little or no production from the Minnelusa rocks. What, then, are the true methods and conditions of oil entrapment in the Minnelusa Formation?

The Minnelusa Formation in this paper includes those rocks below the Permian Goose Egg Formation and above the Mississippian Madison Formation. The Minnelusa Formation has been subdivided in this area into three members by previous authors. The three members are termed Upper, Middle, and Lower. The Upper Member is considered to be Wolfcampian in age and is probably the most important oil producer in the area. The Upper Member has been further subdivided into three rock units named, for simplicity, A, B, and C. A and B appear to be the most productive and also exhibit the greatest stratigraphic variations. Understanding the stratigraphic variations and their relationships to the Laramide structures can lead to a better development program of existing oil fields and further the exploratory efforts in little-drilled areas of the western Powder River basin.

24. JOHN P. WELDON, Tenneco Oil Company, Casper, Wyoming

DILLINGER RANCH FIELD, CAMPBELL COUNTY, WYOMING

Located in east-central Campbell County on the eastern flank of the Powder River basin, Wyoming, the Dillinger Ranch field produces oil from the "B" Sand section of the Permian part of the Minnelusa Formation. The field is defined by 17 wells and 5 dry holes. Total field reserves are estimated to be 5–10 million barrels of oil. The trap is formed by the intersection of a structural nose with an updip truncation of reservoir sandstone in a shale-filled channel.

Post-Minnelusa streams cut deeply into the formation and removed substantial portions of the alternating sandstone, carbonate, and anhydrite sequence. The Opeche Shale was then deposited over the entire basin flank, filling in the drainage valleys. Much later, the Laramide orogeny tilted the eastern flank of the basin toward the southwest. Migrating hydrocarbons were unable to move updip at those places where the reservoir sandstones encountered the impermeable shale seal in the channels. It is anticipated that many more fields will be discovered in the Minnelusa in similar stratigraphic traps along the eastern flank of the Powder River basin.

25. IRVIN KRANZLER, Consulting geologist, Billings, Montana

ORIGIN OF LOWER TYLER OIL IN CENTRAL MONTANA

A study of the Heath (Mississippian) and lower Tyler (Pennsylvanian) sediments of central Montana suggests a close relationship between the oil accumulations and the relative positions of the Heath Limestone and the lower Tyler sandstones. Reconstruction of the pre-Amsden structure and the Tyler-Heath paleogeology shows that the oil accumulations at Sumatra, Stensvad, Ivanhoe, Keg Coulee, Bascom, Melstone, and Big Wall fields occur where the paleo-structural position of the lower Tyler sandstones is updip from, and in direct contact with, the Heath Limestone. The foregoing relationships seem to be further supported by a study of Alice and Porcupine domes. These domes have barren sandstone reservoirs in excellent structural-stratigraphic traps. The paleo-structural attitude in the area of the domes was flat and the Heath Limestone apparently not well developed.

Application of these reservoir-source relationships should be useful in exploring for new oil reserves in the lower Tyler. The concept also may be applicable in other geologic provinces.

26. DONALD E. CAMPAU, Consulting geologist, Billings, Montana, AND BILLY B. LANE, State geologist, Billings, Montana

PROBLEMS OF CORRELATING PERMO-TRIASSIC REDBEDS IN WILLISTON BASIN

Correlation of Permo-Triassic redbeds in the Williston basin is relatively easy when a normal section is present; however, when some of the section is missing because of truncation or salt solution, correlation becomes very difficult, especially where redbeds of Triassic age rest on similar beds of Permian age or older. Poor samples and inadequate mechanical logs within the redbed section make correlation even more difficult. Correlation with the outcrop in the Black Hills is complicated further by the presence of massive salt beds in the subsurface that are not present on the surface.

Salt solution is common and, where faulting and fracturing are known to exist, appears to be related to paleostructures. Failure to recognize this phenomenon could result in misinterpretation of structure, especially when the seismic method is used.

27. A. SATERDAL, Independent petroleum geologist, Denver, Colorado

LOWER CRETACEOUS OIL FIELDS OF NORTHERN SWEETGRASS ARCH, MONTANA

An Early Cretaceous age is considered to be most probable for the group of productive sandstones which are found in the northern Sweetgrass arch and which extend from a basal unit (Cut Bank), that lies directly on the deeply eroded Jurassic Rierdon Shale, upward 200 ft. in the section to include the main productive sandstones at Fred and George Creek and Flat Coulee fields (possible "Moulton" stratigraphic equivalents). Areas of substantial sandstone development, having good reservoir characteristics and oil "shows," occur at stratigraphic positions intermediate between the Cut Bank and "Moulton" and can be found at other localities on the northern Sweetgrass arch.

All of these sandstones have a general relationship with the underlying erosional surface on the top of the Jurassic Rierdon, and thus are indirectly related to each other.

Study of the oil and gas fields from the Lower Cretaceous of the northern Sweetgrass arch is confined for practical reasons to the more recently discovered fields for which electric logs are available. The three most important of these fields are Fred and George Creek, Flat Coulee, and Red Creek. Each produces from basal or near-basal Cretaceous sandstones but differs in detail