havior of the crust beneath the relatively thin sedimentary veneer has been more important in structural evolution than heretofore reported.

23. Gas Occurrence in Piceance Basin, Colorado: Clark Millison, Consultant, Denver, Colorado

Mostly gas is produced in the Piceance basin of western Colorado. The basin, containing about 4,000 square miles, is well defined by the Tertiary-Cretaceous outcrop contact beyond which are the surrounding elevated areas. The basin is in the early stages of development with a density of only one well for every 25 square miles. The lack of pipeline outlet prior to 1956 resulted in slow development but now three pipelines serve the area and drilling activity has been at an accelerated pace. Of the total wells drilled, approximately one half are capable of producing gas from the Tertiary and upper Cretaceous rocks. Due to the thickness of the section, 22,000 feet to the basement, only six wells have tested the pre-upper Cretaceous section.

Most accumulations of gas are due to stratigraphic traps. The paucity of subsurface data is the cause for the present disagreement among geologists of the stratigraphy and geologic history. Tentative correlations from the outcrops on the periphery of the basin are carried across the basin, particularly of the Mesaverde and upper Mancos beds, with a discussion of how the depositional history complicates the problem. The development history which includes the identification of the multiple gas-producing zones indicates that this basin will become one of the important gas-producing areas of the Rocky Mountains.

24. Geology and Occurrence of Gas and Oil, Wamsutter Arch, Wyoming: HOWARD R. RITZMA, Dan Turner & Associates, Inc., Denver, Colorado

The Wamsutter arch is a poorly defined, low-order, positive structural element of southwestern Wyoming. The arch plunges eastward from the northeast bulge of the Rock Springs uplift toward the Rawlins uplift and Sierra Madre uplift, but does not definitely join either of these latter structural elements. The stronger south flank of the arch dips into the Washakie segment of the Green River Basin. The north flank fades gradually into the Red Desert segment of the Green River Basin.

The stratigraphic section follows.

Eocene
Tipton tongue of Green River formation
*Very gentle unconformity*
Hiawatha member of Wasatch formation (minor gas)
Paleocene
Fort Union formation
*Gentle unconformity*
Upper Cretaceous
Lance formation
Lewis shale (with associated sandstones) (oil and gas)
Mesaverde group
Almond formation (oil and gas)
Ericson sandstone (minor gas)
Rock Springs formation
Blair formation
Baxter shale

Gas and oil has been found in the Mesaverde group, mostly in sandstones in the Almond formation. To a lesser extent production has been obtained from sandstones within the Lewis shale and near the Lewis-Lance transition zone and from the Ericson sandstone. There is also minor production indicated from sand lenses in the Hiawatha member of the Wasatch.

Table Rock anticline on the southeast flank of the arch is the only structure with demonstrable surface closure. Tertiary gas was discovered here in 1946 with deeper Lewis and Mesaverde discoveries in 1954. Discovery of major gas reserves at Desert Springs in 1958 triggered rapid expansion of exploratory and development drilling which continues to date. Major new field discoveries include Patrick Draw, Arch, Playa, and West Desert Springs. Productive areas have expanded across original Federal unit boundaries and have overlapped and coalesced, causing numerous problems in nomenclature.

Except for Table Rock, all fields discovered to date are stratigraphic traps with minor structural complexities. Usually the oil and gas is found trapped in closed sandstone bodies formed as offshore bars in the shallow Lewis and Almond seas.

The Wamsutter arch is a young upwarp (possibly Pliocene) superimposed across older Tertiary and late Cretaceous structural trends. The older structural patterns are, as yet, imperfectly known and understood.

25. Relation of Latest Cretaceous and Tertiary Deposition and Deformation to Oil and Gas Occurrences in Wyoming: J. D. LOVE, U. S. Geological Survey, University of Wyoming, Laramie; PAUL O. MCGREW, Professor of Geology, University of Wyoming, and HORACE D. THOMAS, State Geologist, Geological Survey of Wyoming, Laramie

Oil and gas have been known in non-marine Tertiary rocks in Wyoming since 1896. Commercial oil or gas pools have been discovered in Paleocene and Eocene rocks in the Green River, Washakie, and Wind River basins. The source of most of this oil and gas is believed to be sediments deposited under lacustrine conditions during Paleocene time and again during Eocene time. Oil and gas production from nonmarine beds of latest Cretaceous age is a recent development.

The diastrophic and depositional history from latest Cretaceous through Tertiary time has a significant bearing on essentially all Wyoming oil and gas fields. The Laramide orogeny began with gentle folding in latest Cretaceous time, reached a climax of intense folding and thrust faulting in earliest Eocene time in most parts of Wyoming, and was essentially completed by latest Eocene time. Conventional Wyoming oil and gas fields are those related to structural traps formed during this orogeny.

The Green River, Wind River, and Hanna basins were sites of deposition of more than 20,000 feet of latest Cretaceous, Paleocene, and Eocene strata. Oligocene, Miocene, and Pliocene beds were deposited across the now completely filled basins and high onto the flanks of partly buried mountains. Volcanic debris from centers within or near Wyoming comprises the bulk of these young strata. Regional uplift, large-scale normal faulting, and rapid degradation that exhumed the mountains and re-excavated the basins occurred in late Pliocene and Pleistocene time. During this episode some of the structures containing oil and gas were significantly modified.

26. Relation of Uplifts to Thrusts in Rocky Mountains: A. J. EARDLEY, University of Utah, Salt Lake City, Utah

The Rockies concerned are those of Montana, Wyoming, Colorado, New Mexico, and the Colorado Plateau of Utah and Arizona, east of the Paleozoic miogeosyncline.

Evidence is presented that suggests that all the Rocky