east of the town of Riverton, Wyoming, and 5 miles northwest of the Big Sand Draw field. Geologically, the field is on the east side of a south-extending tributary embayment of the Wind River basin.

The Beaver Creek anticline was mapped in detail and leased by the Midwest Refining Company in 1930, on the supposition that structural closure might increase in Cretaceous sediments beneath the unconformity at the base of the gently folded Tertiary Wind River formation. This idea was substantiated by later refraction and reflection seismograph work. Operation of the Midwest Refining Company Beaver Creek leases was assumed by the Stanolind Oil and Gas Company following its organization in 1932.

In 1938, the Stanolind completed the discovery well, the Johnson No. 1, as a 9,000-MCFPD gas well in the Lakota sandstone, following plug-back from total depth of 8,992 feet in the Nugget sandstone. Problems in production and marketing delayed further development until 1945. From 1945 to the present, drilling activity has been dependent on demand for additional gas and development of new oil-producing zones.

Total daily field production is 120,000 MCF gas from the Frontier, Muddy, and Lakota sandstones, and 2,100 barrels of 38°–45° gravity oil from the Mesaverde and Tensleep sandstones and the Madison limestone. A recent deep field wildcat, which bottomed at 13,462 feet in granite wash, failed to find productive oil or gas in the Cambrian.

16. GEOLOGY OF PINCHER CREEK GAS AND NAPHTHA FIELD AND ITS REGIONAL IMPLICATIONS, ALBERTA, CANADA.

W. B. GALLUP, Royalite Oil Company, Ltd., Calgary, Alberta.

For the purpose of this discussion the Pincher Creek area is considered as a geologic sub-province having a somewhat unique orogenic history. Certain sedimentary facies including the reservoir rock were probably subject to orogenic control.

The Pincher Creek field itself is a structural trap involving biostromal Mississippian strata. Ancestral accumulation may have been controlled by the westward pinch-out of the biostrom. A study of the orogenic history explains to some extent the coincidence this facies change has with the outer edge of the foothills.

The absence of foothills in the area may be merely the end result of a series of events and not due to greater age or exceptional conditions of erosion.

17. DISCOVERY PAPER—FERTILE PRAIRIE FIELD, FALLON COUNTY, MONTANA.

JAMES O. STAGGS, McAlester Fuel Company, Billings, Montana.

18. BLACK HOLLOW FIELD, WELD COUNTY, COLORADO.

C. J. MCGINNIS, The California Company, Denver, Colorado.

The Black Hollow field is the only pre-Cretaceous oil producer in the Denver-Cheyenne basin. Production is from the Lyons sandstone of Permian age at a depth of approximately 9,000 feet. The initial test was located on an anticlinal closure defined by the seismograph. The pool covers 1,300 acres on which 10 producers and one dry hole have been drilled. The field is in the development stage. Accumulative production, on September, 1954, totals 430,000 barrels.

19. PINE FIELD, DAWSON, FALLON, PRAIRIE, AND WIBAUX COUNTIES, MONTANA.

JAMES H. CLEMENT, Shell Oil Company, Billings, Montana.

The Pine field is located on the northwest-trending Cedar Creek anticline in Dawson, Prairie, Wibaux, and Fallon counties, Montana. Pine Unit No. 1, the discovery well, was drilled to test a subsurface seismic closure located near the crest of the known surface anticline. The well was completed in January, 1952, daily pumping 467 barrels of 33° gravity crude and 148 barrels of water, from the Upper Ordovician Stony Mountain (Gunton) formation. Subsequent outstep drilling was notable in that improved reservoir conditions were found in the Ordovician, and Silurian production was established in zones found water-bearing in the discovery well.

Thin Devonian strata, shales and shaly dolomites, are effective barriers to vertical migration over Silurian productive zones. Silurian rocks thicken and rise structurally southeastward with associated development of porous and productive intervals. Upper Ordovician strata contain the major productive zones with included shale zones acting as effective cap rocks.

Development indicates oil accumulation in the Pine field to be controlled by structure, but with stratigraphic variation important in reservoir properties. The structure is basically an asymmetric anticline, modified by minor culminations and saddles. Structure contours indicate a closure of approximately 200 feet.

No gas caps are present in the field. Porosities of the pay intervals vary from 6 to 16 per cent with a mean of 11 per cent. The average permeability is approximately 5 md. Connate water in the pay intervals is estimated to average 30 per cent.

The crude oil produced is black, 35° A.P.I. gravity with sulphur content of 0.44 per cent and a GOR of 150. Reservoir pressure is on the order of 4,150 psi. The greater part of the recovery will probably be determined by liquid expansion, and no active water drive has been ascertained.

Approximately 3,800 acres are considered proved productive in the Pine Unit. Eighteen wells have been completed in the Unit, of which 14 are commercial producers, 2 are dry holes, and 2 are

non-commercial wells. One dry hole was drilled on the steep west flank by the California-Canadian Company. Three Unit wells are being drilled at present, and one competitor location is drilling. Development is on an 80-acre pattern.

For the week ending, December 10, 1954, 13 wells produced an average of 1,789 barrels of oil per day. Cumulative production to December 1, 1954, was 681,390 barrels of oil; 94,467 MCF gas.

20. IGNACIO GAS FIELD, LAPLATA COUNTY, COLORADO.
D. M. FEREBEE, Stanolind Oil and Gas Company, Albuquerque, New Mexico.

The Ignacio gas field, a closed anticline in the northeastern lobe of the San Juan basin, has two proved commercially productive zones; one, the Fruitland-Pictured Cliffs, the other in the Dakota-top of the Morrison. Porosity and permeability are the controlling factors in the Fruitland-Pictured Cliffs reservoir, whereas fracturing in the Dakota-top of the Morrison reservoir is of primary importance.

21. DISCOVERY PAPER—ORDOVICIAN OIL IN SOUTHERN BIG HORN BASIN, WYOMING.
A. J. CROWLEY, Continental Oil Company, Denver, Colorado.

22. TIP TOP FIELD, SUBLETTE COUNTY, WYOMING.
RICHARD A. HOWE, General Petroleum Corporation, Salt Lake City, Utah.

The Tip Top field of western Wyoming has two wells producing oil from the Nugget sandstone Jurassic age and several outlying shut-in gas wells capable of production from the Cretaceous Frontier formation. Daily oil production amounts to approximately 300 barrels from a depth of 10,000 feet. Gas wells have an average capacity of 2,000,000 cubic feet per day in the 7,000-foot depth range.

Oil is trapped in the upper fractured part of the Nugget sandstone on the upthrown side of a thrust fault. Frontier formation gas production is localized in both upthrown and downthrown fault blocks on the anticlinal fold.

Low pressure-high volume gas is produced in the Tip Top Shallow and Big Piney gas fields from lenticular sandstones in the Tertiary Wasatch formation.

23. GEOLOGY OF CLEAR CREEK GAS FIELD AND VICINITY, CENTRAL UTAH.
WALTER E. ZABRISKIE, Three States Natural Gas Company, Price, Utah.

The Clear Creek gas field, Carbon and Emery counties, Utah, was discovered in October, 1951, when the Byrd-Frost Corporation completed the Utah Fuel Company well No. 1. The prospect was drilled on a large highly faulted anticline located on the mountainous Wasatch Plateau of central Utah. The producing zone is the Ferron sandstone member of the Mancos shale. Seventeen additional field wells have now been drilled into the Ferron sandstone. Fourteen of these wells were producers, two were dry holes and one was abandoned because of mechanical difficulties.

24. STRATIGRAPHIC GAS DEVELOPMENT IN BLANCO-MESA VERDE POOL OF SAN JUAN BASIN.
R. W. ALLEN, JR., El Paso Natural Gas Company, Farmington, New Mexico.

The Blanco-Mesa Verde gas pool was discovered in 1926 by the Huntington Park Oil Company's Geode No. 1, Sec. 29, T. 30 N., R. 9 W., San Juan County, New Mexico. The area of present production is 64 miles long and 34 miles wide, containing an estimated 847,800 acres. The pool lies in a large asymmetrical syncline. Gas is produced from the Cliff House and Point Lookout sandstones of the Mesa Verde formation of the late Cretaceous.

Gas accumulation is controlled by lenticular sands and permeability and porosity changes in the individual sands. It is suggested that the gas is coming from interfaces rather than from the sand bodies which have very low permeabilities and porosities. Initial well potentials range to 30,000 MCF/D. The cumulative production on January 1, 1953, was 102,888,160 MCF.

25. CAT CREEK OIL FIELD, PETROLEUM AND GARFIELD COUNTIES, MONTANA.
HERBERT D. HADLEY, Billings Geological Service, Billings, Montana.

The Cat Creek oil field of central Montana is one of the oldest and most prolific oil fields in Montana. However, the physical characteristics of the crude, its method of entrapment, and stratigraphic position are anomalous.

The early use of excessive faulting to explain the field can not be substantiated by studies resulting from more recent exploration. Structural evidence seems to indicate a shifting of the subsurface axis toward the steep northern limb of the anticline.

The possible historical relationship of the Cat Creek field, the pre-Cambrian Belt rocks, and the Big Snowy anticlinorium is discussed.

It is concluded that the Cat Creek field has not been completely studied or evaluated and that such a study might lead to finding additional small, shallow oil pools and to a better exploration program for adequately testing the deeper Paleozoic section.

Structural conclusions made for the Cat Creek field may be extended to other structural features throughout central Montana, causing their re-evaluation for possible hydrocarbons.