The end of Cretaceous time in the Piceance Creek basin is marked by broad uplift and local folding, followed by a period of erosion. Flank structures of the basin were extensively eroded and peneplaned before being covered by later sediments. Basal members of the overlying Paleocene sediments usually contain conglomerates of a diversified origin.

Paleocene sediments in the basin are similar to the Mesaverde section. They range in thickness from a few feet on the edge of the basin to more than 3,000 feet in the deep basin, and indicate active structural growth of the basin during this period.

Growth of the basin continued to be active during Wasatch time. Thickness variations of this section indicate that structural deformation was mainly on a broad basis; previously prominent local features within the basin had only slight influence on the thickness of the Wasatch sediments.

Continued growth of the basin is clearly evident in the thickness variations of the Green River sediments. In contrast to the Wasatch period, however, the local structural features within the basin were again active and are expressed in thickness and facies changes.

The present great structural relief of the Piceance Creek basin is mainly the result of tectonic activity following the deposition of the Green River sediments, the last consolidated sediments found in the basin.

The most favorable stratigraphic-type reservoirs within the present economic reach of the drill in the Piceance Creek basin are of Cretaceous and later age. The nearly constant structural deformation of these sediments since their deposition along established patterns has maintained favorable conditions for the accumulation of petroleum in stratigraphic-type traps on the flanks of the basin.

Significant deposits of gas and some oil have been found in stratigraphic traps in widely scattered areas of the basin. Some accumulations appear to have had strong local structural influence; others can have been influenced only by broad structural movements. Apparent economic productive potentials have been measured from nearly all Cretaceous and post-Cretaceous formational units represented in the basin.

M. DANE PICARD, American Stratigraphic Company, Durango, Colorado

White Mesa Field, Environmental Trap, Paradox Basin, Utah

It has been said in the White Mesa field, "Every well is a wildcat." The present study indicates the situation is, perhaps, not entirely uncertain.

Located on the southern flank of the Paradox basin, the field (with one exception) produces from the Desert Creek zone of Pennsylvanian (Cherokee) age. To December 1, 1958, there were 48 oil wells.

Structurally the area can be divided into two units. The southeastern part strikes N. 30° W. to N. 90° E. (averaging N. 30–70° E.), and dips gently west and north at 60–115 feet per mile. It appears probable that this part is the west and north flanks of an anticline located east and southeast of present wells. In the northwestern part of the field, a small area of closure is present. This part trends northwest-southeast, and is related to the Ratherford field northwest of White Mesa. It is separated from the southeastern part of White Mesa by a narrow syncline opening (?) northeast.

Production in the field is from vuggy, bioclastic limestone, secondary dolomite and oölitic limestone.

The Desert Creek zone ranges from 137 to 207 feet in thickness. It is characterized by three centers of thickening: one in the northwest, one in the northeast, and one in the south part of the field.

Stratigraphically the field is an area of rapid lateral and vertical lithologic change. The lithofacies pattern can be divided into three units: high carbonate (limestone-dolomite versus evaporite more than 79%) rocks on the northern margin, similar high carbonate-versus evaporite rocks trending north-south, subsidiary to the northern unit, and a restricted lithofacies (increased evaporite) bordering the northern margin and surrounding the north-south-trending carbonate lithofacies. Because of these variations oil has been environmentally trapped. The specific change most instrumental in entrapment, is the transition from deposits of a shallow, well oxygenated, agitated, marine environment to deposits of a deeper-water, relatively quiet, restricted, marine environment. The latter might be called "lagoonal."

Many wells in White Mesa produce from rocks deposited in the restricted environment; eleven dry holes have found a slightly greater environmental restriction and were not productive due to negligible permeability.

In origin White Mesa and the related fields (Aneth, McElmo Creek, Ratherford) have been called a "reef complex." The writer believes the term biostromal complex to be more descriptive of Desert Creek zone stratigraphy in the area.

R. D. RAMSEY, The Atlantic Refining Company, Billings, Montana

Stratigraphy of Amsden Formation in Wolf Springs-Delphia Area, Central Montana

The Amsden formation thins progressively northward by pre-Piper truncation. This can be demonstrated by stratigraphic cross sections. By means of the same media it can be shown that the Custer anticline and the Delphia structure were both relatively high in pre-Piper time, because the Amsden at both places is thinner than that in nearby off-structure wells. This gives evidence for postulating that these two Laramide structures had some expression in post-Amsden, pre-Piper time. The same "thins" show up in Amsden isopachous maps.

The Amsden formation in central Montana produces commercial quantities of oil at the Wolf Springs, Delphia, Gage, and Big Wall fields. Stratigraphic studies of the productive intervals at Wolf Springs and Delphia and the surrounding area show that reservoir space in the form of vugs and fractures has been developed in the dense upper dolomite part of the Amsden. Development of such vuggy porosity came about as a result of the dolomite being exposed to a prolonged period of pre-Piper sub-aerial erosion in this general area. Fracturing along pre-Laramide structural highs (later modified by Laramide folding) provided solution channels for ground-water movement. Typically, the Amsden pay is a dense, light-colored dolomite, commonly cherty, vuggy, and fractured. In some places it is breccia-like in appearance and may include chert in the form of irregular inclusions and vug linings. Very little, if any, porosity is intercrystalline.

Subdivision of the Amsden is possible by the use of electric logs. The Amsden can be divided into upper and lower zones stratigraphically on the basis of using a persistent low-resistivity kick as the dividing line. Both zones produce oil. Either can be considered a possible reservoir, depending on whether that part of the section is subjacent to the Piper and hence was exposed at the unconformity surface by erosion.

J. E. RENAUD, Consultant, Calgary, Alberta

Provost Gas Field, Alberta, Canada

The Provost gas field is located in east-central Alberta about 172 miles northeast of Calgary, Alberta, Canada. It is typical Upper Cretaceous gas field and one of the most important shallow (2,690 feet) gas accumulations in Alberta.

Gas production is from the sand member of the Viking formation. There are 63 gas wells in the field and ultimately about 394 gas wells will be on production. The proved and probable gas reserves are 926 billion cubic feet and they cover an area of 333,853 acres. The average reservoir pressure is 850 psi. The gas reserve is committed for sale to the Trans-Canada pipeline system and at present 33 million cubic feet per day is being sold. The accumulation of gas in the Provost field is due to updip pinch-out of the Viking sand, in turn overlain by Colorado shales. Other gas fields of similar type, such as the Viking-Kinsella are present in east-central Alberta. Planned wildcat drilling will probably uncover similar accumulations in the prospective east-central Alberta belt.

J. W. ROLD, The California Company, Denver, Colorado

New Windsor Oil Field, Dual Stratigraphic Trap

The New Windsor field, on the west flank of the Denver basin 50 miles north of Denver, produces oil from two superposed stratigraphic traps. The shallower is an updip sand pinch-out of the Upper Cretaceous Sussex sand at 4,200 feet. The deeper is an updip permeability barrier in the Permian Lyons sandstone at 9,000 feet.

The discovery of the field provides an illustration of the successful integration of geophysical, stratigraphic, and structural geology. The first well, located on a seismic structure, found the Lyons tight, with an oil show, and encountered no Sussex. A second well, located down the northeast plunge of the structure, encountered porous, permeable Lyons and Sussex sands and proved potential stratigraphic traps. A third well, Calco's Brunner No. 1, which was located between the two, indicated commercial production from both the Sussex and Lyons and was completed for 108 barrels of 41° oil from the Lyons.

Seismic and subsurface data show the New Windsor structure to be a northeast-trending anticline approximately 6 miles long and 2 miles wide. The traps are formed by the nearly coincidental transection of the northeast plunge of the anticline by the Sussex pinch-out and the Lyons permeability barrier.

The Sussex, which is called the second or middle Hygiene along the Front Range and is correlative with the Sussex of the Powder River basin, consists of a series of coalescing bar-like sands 6–12 miles wide from east to west and at least 100 miles long north and south. Five wells are currently producing oil from the updip pinch-out of this "bar."

The Permian Lyons sand is fine-grained, cross-bedded and well cemented by silica and anhydrite. The only apparent stratigraphic change across the field is an abrupt loss of porosity and permeability from east to west. A dry hole east of production cored 62 feet of porous sand with 2,436 millidarcys permeability. A dry hole west of production had a total permeability of only 1.8 millidarcys. Three wells are currently producing oil from the Lyons.

Stratigraphic traps in the Lyons and Sussex sandstones are proved by the small but significant