with marine shale. In the eastern part of the basin four formations are readily distinguishable; they are, in ascending order, the Eagle Sandstone, Claggett Shale, Judith River Formation, and Bearpaw Shale. In the western part of the basin the equivalent stratigraphic section includes the Mesaverde (Gebo Formation of Hewitt), and the Meeteetse Formation. Non-marine deposits of the Lance Formation, including locally the Fox Hills Sandstone, overlie the Meeteetse-Bearpaw section.

Major transgressions are evidenced by the Claggett and Bearpaw shales and regressions by the nearshore and non-marine sediments of the Eagle, Judith River, and Lance formations. Minor transgressions and regressions produced a complex interfingering of sand and shale that complicates formational boundaries.

Isopachous maps, utilizing all available well information as well as fourteen partial surface sections, were compiled to show the distribution of each of the formations. The stratigraphic interval containing the Eagle Sandstone thickens from 200 feet near the Wyoming-Montana line to 800 feet along the south margin of the basin, but the sandstone content decreases southward as the over-all interval increases. Eagle sands are particularly well developed in the area between Worland and Coon Creek. The Claggett Shale is recognizable throughout the east half of the basin and reaches a maximum thickness of 275 feet along the eastern margin. The Judith River and Mesaverde formations thin northward and eastward throughout the basin while the overlying Bearpaw Shale displays a reciprocal relationship ranging in thickness from zero in the southwestern part to 1,000 feet in the north end. In the south part of the basin the Judith River is divisable into three mappable units: upper sandstones, middle continental deposits, and lower sandstones.

*Marine and transitional beach environments, that* have produced sandstone reservoirs and petroleum accumulations in several other basins in the Rocky Mountains are well represented in the Eagle, Judith River, and Bearpaw of the Big Horn basin. Numerous littoral and neritic sandstones provide a variety of trapping conditions in conjunction with both old and present-day structural features. Embryonic development of Laramide structures during late Cretaceous resulted in (1) thinning of sediments over some of the major structural features and (2) the accumulation of thicker and more porous sandstones along the flanks and over the crests. Examples of depositional thinning of the Claggett Shale may be observed in the vicinity of Five Mile, Worland, Slick Creek, and Sand Creek fields. Local thinning of the Judith River interval occurs at Worland and Slick Creek fields. Similar Laramide structural growth patterns have been mapped in association with oil and gas production in the Patrick Draw-Table Rock area of the Great Divide basin in southern Wyoming.

In approximately 60 per cent of the basin the top of the Judith River and Mesaverde is at a depth of 8,000 feet or less. There is no petroleum production from Upper Cretaceous rocks of the Big Horn basin at the present time. Significant shows have been found at (1) Neiber anticline where a well blew out and burned from gas in the Eagle, (2) Golden Eagle field where three cable-tool wells produced gas from the lower Mesaverde during the early stages of the field's development (1918–1923), (3) Golden Dome and Dry Creek fields in Montana where gas was produced from a zone in the lower Mesaverde, and (4) at the Berwin area northwest of Badger basin where oil was recovered on drill-stem tests of the lower Mesaverde. Smaller shows of oil and gas have been encountered in several other wells.

17. EDWARD L. REID, Murphy Corporation, Casper

### Oil and Gas Occurrences in Disturbed Belt of Southern Alberta and Northern Montana

Several of the most important "disturbed belt" hydrocarbon occurrences are briefly summarized in order of discovery and development.

The hydrocarbon trap at Turner Valley is primarily structural; however, there are some indications of pre-structural stratigraphic control of accumulation. The Highwood structure, 2 miles west of Turner Valley, has tested only water from the Mississippian. Producing porous zones at Turner Valley can not be easily correlated with porous units at Highwood, indicating that there may never have been a direct connection between the two reservoirs. In addition, some wells drilled east of Turner Valley have encountered tight Turner Valley producing zones. Gas reserves originally in place at Turner Valley were 1.74 trillion cubic feet.

Hydrocarbons at Jumpingpound are structurally trapped in the updip edges of a thrust-faulted Rundle slice. Jumpingpound will eventually produce about 700 billion cubic feet of gas.

Surface geology in the Pincher Creek area does not suggest the presence of an anticlinal fold or large thrust sheet at depth. In contrast to steep west-dipping surface beds, the Mississippian rocks of the reservoir block at Pincher Creek dip southwest at only 4°–8°. Pincher Creek accumulation is structurally controlled. Current estimates give Pincher Creek 2.29 trillion cubic feet of gas reserves. During the past 5 years, four more important discoveries have been made in the Waterton and Castle River areas near Pincher Creek. Structurally these blocks lie above and west of the Pincher Creek block.

Total in place Mississippian gas reserves in Southern Alberta "disturbed belt" fields currently stand at 8 to 8.5 trillion cubic feet.

Early and recent oil and gas occurrences in the Montana part of the "disturbed belt" are briefly reviewed. Wildcat density, time of structural movement, degree of crustal shortening, and Mississippian stratigraphy are suggested as possible reasons for lack of economic success in the Montana part of the disturbed belt. Mississippian stratigraphy and its influence on hydrocarbon accumulations near the disturbed belt are illustrated with the suggestion that the combination of proper stratigraphic and structural conditions have not yet been found in the Montana disturbed belt.

18. SIDNEY B. ANDERSON, North Dakota Geological Survey, Grand Forks

### Selected Devonian Possibilities in North Dakota

The Devonian System of North Dakota consists of rocks of Middle and Upper Devonian age. The Middle Devonian is represented in ascending order by the Winnipegosis, Prairie, and Dawson Bay Formations and the lower part of the Souris River Formation. The Upper Devonian is represented by the upper part of the Souris River Formation, the Duperow, and Three Forks Formations. These formations represent a total Devonian thickness of about 650 feet in south-central North Dakota, approximately 1,400 feet in the north-central North Dakota and about 800 feet in the southwestern part of the state. These units are dominantly carbonate rocks, the principal exceptions being the Three Forks shale and the evaporites of the Prairie Formation.

Though there is no Devonian production in these