logical implications are described. Possible application in other areas, such as the Basin-and-Range Province, is suggested with reference to the geological influences which may be important.

9. JAMES L. TATUM, Independent, Albuquerque, New Mexico
Oil and Gas Possibilities of the Paradox Basin

In all developed areas most productive horizons have shows, over large portions of the area. Conversely, most horizons that have shows eventually produce commercially over at least part of the area. In this region shows have been widespread through the Pennsylvanian, Mississippian, and Devonian. Ordovician has been identified at Boundary Butte and tentatively so at Horsefly with shows. Porosity has been poor but of such nature that only slight improvement is necessary in several zones to cause these to be commercially productive. The salt anticlines were growing during Hermosa time with variations in conditions of deposition and character of beds, making these features attractive for exploration. Continued exploration is confidently expected to discover oil and gas fields of importance over a vast region.

10. PAUL H. UMBACH, Consulting Geologist, Albuquerque, New Mexico
Statistics on Exploration of the Four Corners Area, New Mexico, Colorado, Utah, and Arizona

Two hundred sixty-seven wells were drilled in the San Juan basin in 1951 compared with 117 in 1950. Of those drilled in 1951, 46 were wildcats compared with 21 wildcats in 1950.

In the Paradox basin twenty-five wildcats were drilled in 1951 compared with 12 in 1950.

In the Black Mesa basin two wildcats were drilled in 1951, the same number as were drilled in 1950.

Fifty-one per cent of the wildcats drilled in the San Juan basin in 1951 were productive compared to 55 per cent in 1950.

Most of the wildcats became extensions of present pools. One shallower pool test in Rio Arriba County resulted in the Dogie Canyon oil field.

Kutz Canyon, West Kutz Canyon, Blanco, and Ignacio gas fields have been extended.

Aztec gas field has been revived and extended.

11. JOSEPH L. BORDEN, Pure Oil Company, Durango, Colorado
Paradox Formation

The principal occurrence of the Paradox formation is in a northwest-southeast trending basin west of the Uncompahgre uplift, chiefly in southwest Colorado and adjacent portions of southeast Utah. It extends, roughly, from Barker Dome on the Colorado-New Mexico line, northwestward to the vicinity of Green River, Utah. It is approximately 200 miles long and 115 miles wide. The town of Monticello, Utah, is near the geographical center. It is a structural basin lying between the Uncompahgre-San Juan Mountains on the east and the San Rafael-Circle Cliffs upwarps on the west. It is separated from the San Juan basin on the south by a relatively low saddle, and perhaps from the Uinta basin to the north by a similar saddle.

The Paradox is a depositional wedge, within the Hermosa formation. It is lower Pennsylvanian in age. Similar sediments of black shale, gypsum, and anhydrite of Pennsylvanian age occur in the Eagle-Glenwood Springs area, east of the Uncompahgre and on the east flank of the White River uplift. While these sediments probably are equivalent to the Paradox formation, there is no evidence to indicate that the basins were ever connected, and the term Paradox formation has not been applied, officially, to the sediments in the Eagle basin.

The chief exposures of the Paradox occur in Gypsum Valley, Paradox Valley, Sinbad Valley, in Colorado, and in Moab-Spanish Valley, Onion Creek, and Cache Creek-Salt Valley in Utah; all of which are commonly referred to as breached salt anticlines. In these exposures the Paradox consists of irregular beds of gypsum, limestone, dark shales and some find sands. In many places these beds are highly contorted and brecciated, indicating flowage from a deeper source, and contain blocks of foreign material dragged up from below.

The maximum thickness of the Paradox is unknown, but in one occurrence it exceeds 10,800 feet, although this undoubtedly represents flowage rather than depositional thickness. Several wells which have drilled a normal section have had in excess of 2,000 feet.

The section is so irregular that no correlation horizons which can be used for more than local work have been established. In the salt anticlines the section is so garbled and twisted that little bedding remains, and thickness cannot be established. No exposure out in the basin exhibits the base, but in Salt Valley blocks of conglomerate, believed to have been dragged up with the salt, may represent the underlying formation.

12. O. J. LILLY, Consultant, Farmington, New Mexico
The Doswell Oil Field, Rio Arriba County, New Mexico

The Doswell oil field lies near the geographic center of the San Juan basin, in the northern portion of Township 26 North, Range 6 West, Rio Arriba County, New Mexico, approximately 42 miles

ROCKY MOUNTAIN SECTION OFFICERS

Incoming officers of the Rocky Mountain Section of the A.A.P.G. at the annual meeting in Salt Lake City, Utah, February 28–29. Left to right: secretary T. C. Hiestand, Cities Service Oil Company, Casper, Wyoming; president Alexander Clark, Williston Oil and Gas Company, Casper; vice-president Paul H. Umbach, consulting geologist, Albuquerque, New Mexico. Approximately 1,200 people attended the meeting. Photograph by courtesy of the *Oil and Gas Journal*.

southeast of the town of Farmington. The field was discovered by the late Thomas W. Doswell and the late Todd M. Pettigrew and is now controlled by Lowry et al. Previous to the discovery, two non-commercial tests were drilled into the Morrison formation.

The discovery well, Doswell-Pettigrew No. 2 Scott-Federal, NW/4 SE/4 of Section 9, Township 26 North, Range 6 West, was completed in July, 1951. It was drilled to a total depth of 6,700 feet, through the Tocito, and completed for an initial production of 404 barrels of oil daily, flowing through 12/64-inch choke.

Average daily production from the No. 2 Scott-Federal to January 1, 1952, was 390 barrels of oil, and the Lowry et al. No. 4-13-132 Federal, the second producer, NE/4 NE/4 of Section 9, Township 26 North, Range 6 West, has averaged 186 barrels of oil daily since completion. Cumulative production of the field to January 1, 1952, was 64,054 barrels of oil.

The limits of the field have not been defined; however, one mile south and updip from the discovery well, the Doswell-Pettigrew No. 1 State found the Tocito sandstone to be tight and shaly.

The Doswell field probably represents a stratigraphic trap with no apparent structural uplift; however, subsequent drilling may indicate the presence of a structural trap, and sand conditions are the determining factor for oil accumulation.

The producing formation, the Tocito sandstone lentil of the Mancos formation of Upper Cretaceous age, has been correlated with the Gallup sandstone, a tongue of the lower Mesaverde formation. The Tocito sandstone of marine deposition lenticular, and cross-bedded, has good development in the upper and fair development in the lower part.

13. JOHN W. HARSHBARGER, U.S.G.S., Holbrook, Arizona
The Cow Springs Sandstone Formation of the Black Mesa Basin and Adjoining Areas

The Ground Water Branch of the United States Geological Survey is making an investigation of the ground-water resources of the Navajo country. The recognition of intertonguing, lateral gradation, and facies changes within strata of Jurassic age is essential for exploration of water in the Navajo country. One of the major physiographic features of the region is the Black Mesa basin in northeastern Arizona.

Several Upper Jurassic formations in the area grade laterally and intertongue southwest into a distinct eolian-sandstone phase, which the writer has named the Cow Springs sandstone. This sandstone was deposited in the southern part of the region at the same time that subaqueous Upper Jurassic strata were being laid down in the northern part of the region. The type locality of the Cow