band of deposition between the area of continuous beach sands and the seaward pinch-out of the Gallup tongue. In addition, fractured reservoirs with poorly developed sands could be expected throughout this band and for a short distance seaward.

WILLIAM WYMAN MALLORY, Ball Associates, Denver, Colorado

Rocky Mountain Association of Geologists Symposium on Pennsylvanian Rocks of Colorado

The Rocky Mountain Association of Geologists, Denver, Colorado, published in 1958 a volume with the above title in conjunction with its field conference on Pennsylvanian rocks of the Maroon basin.

The principal results of these collected studies show that Pennsylvanian tectonism was dominated by vigorous growth of northwest-trending mountain ranges (Frontrangia and Uncompahgria) and their attendant depositional troughs. These obliterated the amoeboid patterns of gentle epeirogeny in Colorado established during early and middle Paleozoic time. Pennsylvanian depositional history began in Colorado with the accumulation of a red clay regolith, the Molas formation, upon the maturely dissected Mississippian Leadville limestone. Four Pennsylvanian depositional basins (or troughs), the Denver, Maroon, Paradox, and Raton, between and adjacent to Uncompahgria and Frontrangia, contain abundant thicknesses of all lithologic types common to cratonic sediments. Two of the basins in western Colorado, the Maroon and Paradox, exhibit extensive evaporites, the Paradox and Eagle sequences. All the basins contain large volumes of red, arkosic conglomerates and finer clastics (the Fountain, Maroon, Cutler and Sangre de Cristo formations) which grade laterally into marine limestones, shales and sandstones with or without passing through an evaporite facies.

Western Colorado marine sequences bear the names Hermosa group, Morgan formation and Weber sandstone. In the Raton basin the Sangre de Cristo and the Magdalena group, predominantly clastic, comprise the section. In the Denver basin, only the Fountain arkose facies outcrops (except for a trace of Glen Eyrie claystone near Colorado Springs); the series terms Morrow, Atoka, Des Moines, Missouri, and Virgil have been borrowed from the Mid-Continent region as faunal subdivisions.

The uplifts attained maximum development in the Des Moines epoch and continued tectonically active into middle Permian or Leonard time. Pennsylvanian deposition carried over without hiatus into the Wolfcamp epoch of the Permian period. The rejuvenated Uncompahgre and the Front range uplifts (now masked by the Laramide Front and Park Ranges) are part of the present tectonic pattern of Colorado.

The bulk of Colorado oil may be classified as follows: (1) Cretaceous sandstone lenses scattered across the Denver basin, (2) the Weber sandstone of the Rangely pool in the Maroon basin, (3) the Hermosa carbonate reservoirs in the Paradox basin. The last two, Permo-Pennsylvanian in age, contain outstandingly important additional reserves. The size and relative youth of Pennsylvanian carbonate pools indicate that additional large reserves can be anticipated in these rocks.

R. G. MCCROSSAN, Imperial Oil Limited, Calgary, Alberta

Application of Resistivity Mapping to Upper Devonian Interreef Ireton Formation of Alberta

The Woodbend group of Upper Devonian age in central Alberta is a reef complex characterized by large-scale facies changes. The reefs, which grew in a subsiding basin and were initiated in restricted areas of suitable depth, are surrounded by the calcareous shales and argillaceous limestones of the Duvernay and Ireton formations. Isopach maps indicate relative movements of the basin during deposition. Very fine carbonate clastics derived from the reefs were spread throughout the basin during Duvernay and lower Ireton time. The distribution of these carbonates was detected by mapping the average apparent resistivity of a stratigraphic interval from borehole measurements.

The pore volume of these rocks decreases with increasing depth and carbonate content, and resistivity increases correspondingly. The straight-line relation of carbonate content and porosity suggests that reduction of porosity is directly proportional to the volume of calcite grains present. Other factors affecting porosity aside from carbonate content and depth of burial are small by comparison. Internal redeposition of calcium carbonate has been unimportant.

Resistivity mapping in the subsurface shows promise of being a useful exploration tool for determining the relative amount of coarser grains in shale.

RICHARD M. MODEL and JOHN J. SCHULTE, Northern Pacific Railway Company, Oil Development Department, Billings, Montana

Oil and Gas Possibilities of Porcupine Dome, Rosebud County, Montana

"What is the matter with Porcupine dome?" This question is often asked by explorationists working in central Montana. Although it does not have as much closure as some central Montana structures, in areal extent it is the largest feature in the Big Snowy anticlinorium. Twenty wells drilled