local drilling and by close observation of individual well productivity.

Primary porosity is generally absent. Whole-core analysis reveals a fracture porosity average of 2% or less and an average net effective productive interval thickness range of 50–400 ft.

Reserves are limited and estimates differ in direct proportion to the fracture density, gas/oil ratios, initial potentials, and total number of producing wells in an area. Commercial production can be obtained if the available facts are evaluated properly.

13. L. E. GATEWOOD, Consultant, Oklahoma City, Oklahoma

CRINER-PAYNE AREA, STUDY IN STRUCTURAL GROWTH

Criner-Payne field, located in T. 5 and 6 N., R. 3 W., is the largest oil field in McClain County in terms of reservoir oil in place and areal extent. It is near the southern end of the Nemaha ridge. This highly faulted structure owes its present position to local crustal downbreaking along the flanks of the regional Hunton uplift. Continuous structural growth occurred from Ordovician through Pennsylvanian time as a result of a subsiding Anadarko basin; gentle progressive compressional folding culminated in the sharper folds and faults near the rim of the syncline.

Post-Hunton tilting and truncation, and post-Morrowan—pre-Desmoinesian uplift, can be matched closely with the stages of evolution of the Anadarko basin and the Nemaha ridge. The growth and tilting have resulted in the shifting of the younger fold axis progressively eastward from the Simpson axis.

The field is characterized by two distinctly different producing zones. The Bromide Sand, with structural relief of about 1,700 feet, produces only on up-thrown closures against north-south-trending faults. The Bois d'Arc Member of the Hunton Limestone has structural relief of about 1,650 feet, but the oil occurs generally wherever there is porosity and (or) fracturing, without regard to the structural position. Most Hunton porosity occurs west of the fold axis on the more steeply dipping western flank which was more exposed during intermittent stages of growth and tilting. Approximately 80% of the total acre-feet of Hunton porosity is localized west of the fold axis, but this comprises only about 35% of the total Hunton productive area.

14. L. R. RILEY, Humble Oil & Refining Company, Ardmore, Oklahoma

CHALLENGE OF DEEP EXPLORATION—CHITWOOD POOL, GRADY COUNTY, OKLAHOMA

In February, 1965, the South Alex and Chitwood producing areas were consolidated and designated Chitwood. These two Bromide producing areas are closely related geographically and geologically, and both are included in this discussion. Emphasis of this discussion is placed on the deeper producing Simpson rocks.

Even though there is this close relationship, geological and reservoir data indicate that the two areas are separate. Based on structural data from subsurface and seismograph, the two producing areas are located on separate anticlines. This interpretation is supported by differing condensate ratios in the wells of the two sectors.

Production ranges in depth from 15,908 to 17,202 ft.; Oklahoma's deepest productive well is located in the South Alex part of the field.

Production capabilities of the wells appear to be related directly to porosities and permeabilities which change significantly from well to well. The changes are sufficiently great that wells range from very good producers to dry holes.

Data from petrographic analysis indicate a small amount of pressure solution and a large amount of secondary silica growth. Both factors decrease original porosity of the reservoir.

Predicting the presence or absence of porosity is a most difficult problem. Extremely high drilling costs make it necessary to drill a minimum number of dry holes. Subsurface control from 640-acre spacing leads to unreliable development predictions.

15. R. C. LARSON, Larson Exploration Company, Tulsa, Oklahoma

HEALDTON ARBUCKLE FIELD AND ITS RELATIONSHIP TO OTHER POTENTIAL ARBUCKLE STRUCTURE

The Healdton Arbuckle oil field of Carter County, Oklahoma, is an example of a large reservoir for which ample subsurface information was available to the exploration geologist prior to discovery. In the application of refined and sophisticated exploration techniques elsewhere, the industry ignored basic and fundamental subsurface facts in this area. This pool is located in the middle of a productive zone that pre-dates World War I. Oil in the Arbuckle actually was produced from this reservoir for many years before the Sinclair No. 1 Ratcliff was drilled to find what is now recognized as the Healdton Arbuckle field. This paper deals with the facts leading to the Sinclair discovery and it attempts to reveal how they may be used to find additional pools. It is felt that a basic understanding of the producing pool is requisite to intelligent exploration for additional traps of a similar type.

16. K. H. HOLMES, Mobil Oil Company, Oklahoma City, Oklahoma

STRATIGRAPHIC TRAPS IN NORTHWEST QUINLAN AND CEDARDALE FIELDS, NORTHWESTERN OKLAHOMA

Northwest Quinlan and Cedardale fields in eastern Woodward and western Major Counties, Oklahoma, are located on the northern shelf of the Anadarko basin. Both fields produce gas from stratigraphic traps in the Mississippian Chester Limestone. Production at Cedardale is primarily from the Pennsylvanian Cottage Grove Sandstone.

Traps in the Chester were formed by lateral changes in the original limestone deposition and cementation. Original porosity and permeability were later altered by subaerial leaching which preceded the deposition of the overlying Pennsylvanian sediments.

The trap in the Cottage Grove Sandstone was formed by an updip facies change from sandstone to shale on the gently sloping shelf.

Cedardale was discovered in 1957 and Northwest Quinlan in 1958. Production has been established in 55 sections and development drilling is continuing with the limits of these fields still not defined.

17. J. F. JOHNSON, Sinclair Oil & Gas Company, Tulsa, Oklahoma

RECENT ADVANCES IN GEOLOGY AND GEOPHYSICS

No wholly new exploration techniques have evolved during the past 10 years. However, geologists and geophysicists have learned that there is more to discovering oil fields than the detection of closed structures and the selection of sites where rocks have sufficient porosity to hold oil. They have realized that oil fields are located only in favorable geological settings characterized by certain large-scale geological features. They also have realized that it is possible, using geology and geophysics,