tion of oil and gas. With a possible exception of one or two domes, these *deep-seated* domes are all now producing.

The locations of the *piercement* domes have been known for 30 years, and it is only within the past few months that the producing possibilities have been realized. Two of the *piercement* domes in East Texas have been producing for 30 years and since July, 1956, 3 additional domes in East Texas and 1 in Louisiana have been found to be productive.

The subsequent drilling has changed our conception about the age and origin of the domes. It now appears that, instead of growing from the center and deepest part of local synclines, these *piercement* domes are so tremendous in size and have grown for such a long period of time that their growth has created the local basin as a large rim syncline.

Every known type of geological trap should be present at some depth in proximity to each dome.

Delaware and Val Verde Basins, Texas-New Mexico

C. D. VERTREES, Consulting Geologist; GLEN EGANS, Louisiana Land and Exploration Company; and C. HAYDEN ATCHISON, British-American Oil Company, Midland, Texas

The Delaware and Val Verde basins are structural basins which lie between the structurally positive Delaware and Davis mountains and the Marathon thrust belt on the west and south, and the structurally positive Central Basin platform, Ozona arch, and southern end of the eastern shelf on the east. The northern boundary of the Delaware basin is the northwestern shelf of southeastern New Mexico. Because of very meager subsurface control the southern limit is not definitely known but it could include the Kerr basin. The widest part is across the Delaware basin which extends 100 miles east and west. The two basins have a combined length of about 275 miles.

The seaway in which the lower Paleozoic sediments of this area were deposited was elongated east and west. Therefore, the depositional strike of the lower Paleozoic formations was approximately at right angles to the late Paleozoic structural trend. Although there were several periods of tectonic readjustment during early Paleozoic time which varied the sedimentary sequence, it was not until the post-Mississippian orogeny that the Delaware and Val Verde basins began to assume their present form.

During Pennsylvanian time this area, due to compressive forces from the south, began to assume the northwest-southeast structural trend, and by early Permian time intensified pressure resulted in a very deep structural trough. The extremely thick section of Wolfcamp sediments was deposited in this trough which included both the Val Verde and Delaware basins. No evidence of a separation of this basin is found until late Paleozoic time when the Capitan reef grew along a barrier which had formed between the west flank of the Central Basin platform, west of Fort Stockton, to the Glass Mountains. This Capitan reef formed the south line of the Delaware basin and the north line of the Val Verde basin.

In the Delaware basin the first commercial oil field was found in the Wheat field of south western Loving County, Texas, in 1924. Production in this field was encountered in the upper sands of the Delaware Mountain group. Since then approximately 20 important oil or gas areas have been found in the upper Delaware Mountain sands. The few deep tests drilled show extremely thick sections of probable hydrocarbon source beds and many reservoir beds. Many deep oil or gas accumulations are anticipated from reservoirs in the Ellenburger, Simpson, Hunton, Morrow, and Leonard.

In the Val Verde basin intensive oil or gas prospecting started with the discovery of the Puckett gas field in 1952. This field is 8 miles long and 4 miles wide and has a closure of approximately 2,000 feet. It produces gas from both Devonian and Ellenburger and according to tests it contains some of the largest gas wells in the world. Southeast of the Puckett field the Brown-Basset gas field was discovered in 1958. Although the limits of the field are not yet known, it now appears it will exceed the Puckett field in size and equal it in caliber of gas reserves.

Stratigraphic Controls on Pennsylvanian Oil of Paradox Basin, Four Corners Region
SHERMAN A. WENGERD, University of New Mexico, Albuquerque

Whether called an embayment, a re-entrant, a basin, a sag, or a geosyncline, the area underlain by the Paradox prism of sedimentary rocks is today no one of these. This prism reveals a complex history of (1) lithologic variation, (2) diverse tilt, and (3) structural deformation. The Paradox facies of the Four Corners region contains important reserves of Pennsylvanian oil. The *lithologic variation* of any specific sedimentary unit is a function of sedimentational history controlled by provenance and tectonism of the source area, type of transporting agent, chemistry of the marine water, and condition of the sea bottom. The *stratigraphic variations* involve thickness, intersection of bedding surfaces, diastems, and disconformities, and space available for deposition; all of which are closely related to the tilt history as well as the positive or negative shifts of the effective wave and current base. These, then, are the controls which affected the juxtaposition of different rock types to yield linear controls on the early regional migration of gas, oil, and water phases. The *structural deformation* of the Paradox prism, often considered to have occurred at finite points or areas in time such as "Laramide" or "mid-Tertiary," in reality must have occurred almost continuously from the initiation of Paradox basination in early Cherokee time, to the present time. This concept, applicable to most Pennsylvanian basins of rapid subsidence, involves recognition of directions and amounts of regional tilt by mapping finite member thickness, specific lithologic character, probable successive fluid types, and possible directions of fluid movement throughout post-depositional history of that member. These data are equated within the framework of the inferred compactional history for each stratal member during basinal subsidence. Early gentle folding occurred parallel with the facies strike and the general strike of stratal convergence during the areal crowding of the basin. These earlier gentle structures appeared in areas of relatively greater lithologic competence ("reefs") near the break-in-shelf slope, and provided the major traps for Pennsylvanian oil.

There can be little doubt that later tectonic events not only modified but probably destroyed many oil accumulations as well as masking the locations of the several large Aneth-type fields still to be found in the Four Corners region.

Structure of the Frontal Belt of Ouachita Mountains
THOMAS A. HENDRICKS, Pan American Petroleum Corporation, Tulsa, Oklahoma

The structure of the frontal belt of the Ouachitas is dominated by faulting. The faulting in general consists of a complex set of reverse faults roughly parallel with the Ouachita Mountain front and a related set of cross faults. Most of the reverse faults appear to dip at high angle and to have a horizontal component of movement that is of the order of magnitude of the vertical movement. Others, such as the Pine Mountain and Windingstair faults, appear to have had greater horizontal movement than vertical movement, and at least locally appear to dip at moderate angles. The Ti Valley fault and some minor faults appear to have a low angle of dip. The cross faults are of two types. In the northern part of the area they are characterized by strike-slip movement. South of the Windingstair fault the movement was dominantly upward. The minimum amount of movement on the reverse faults in the frontal belt appears to have been in excess of 50 miles, with the greatest part of that movement concentrated on the Ti Valley, Windingstair, and Pine Mountain faults. More or less simultaneous deformation seems to have occurred in an extreme frontal block, the block between the Ti Valley and Windingstair faults, and the block south of the Windingstair fault, with the deformation culminating in movement on the Ti Valley and Windingstair faults. Several lines of evidence suggest that the direction