conglomerate. It is a large fan deposit, which may be correlative to the Anahuac formation, or the Soledad formation.

Unconformably above the Norma, or the Frio, is the Anahuac formation. The three foraminiferal zones, *Discorbis*, *Heterostegina*, and *Marginulina*, are recognized in northeastern Mexico. All are productive.

The most important fields discovered in the Frio-Vicksburg trend are Brasil, Reynosa, Cano, and Trevino, where development drilling is still going on. The 18 de Marzo field is important as a gas producer from the *Marginulina* zone of the Anahuac, and the Trevino field produces from the *Heterostegina* zone.

Geology and Petroleum Development of Continental Shelf of Gulf of Mexico

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The stratigraphic and structural framework of the Gulf of Mexico is described, with particular reference to that part of the continental shelf with water depths of less than 200 feet, which is considered the limit of economic accessibility for petroleum exploration. This limit encompasses 96,000 square miles bordering the coast of the United States and 56,000 square miles bordering the coast of Mexico. Of this total area, only the 20,000 square-mile area off the coast of Louisiana has provided economic success as the result of offshore exploration. Approximately 2.5 billion barrels of oil and 9.5 trillion cubic feet of gas had been outlined by the drilling of 2,019 offshore wells to July 1, 1958. Though 162 offshore prospects have been tested, these represent only about 50 per cent of the structures indicated by geophysical data.

Maps of the Gulf of Mexico are presented showing the extent of the Quaternary, Late Tertiary, Early Tertiary and Mesozoic sediments that are considered proved or prospective for petroleum exploration on the continental shelf within the 200-foot water depth limit.

As examples of typical offshore salt-dome fields, structure maps and cross sections are presented for the Block 126 field, Eugene Island area and the Block 110 field, West Cameron area, Louisiana. As an example of the magnitude of associated salt intrusions, a structure map of the Marchand-Timbalier-Caillou Island salt massif is given. This salt massif contains 265 cubic miles of salt down to the mapped depth of 20,000 feet, and assuming the salt extends downward with vertical sides from that depth to a depth of 50,000 feet, an estimated 1,400 cubic miles of salt are present.

The occurrence of the sulphur deposit on Block 18 dome, Grand Isle area, Louisiana, where the Freeport Sulphur Company is beginning mining operations, is illustrated.

Interior Salt Domes of Texas, Louisiana, and Mississippi

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Texas, Louisiana, and Mississippi have a total of 90 interior domes which have been classified as *piercement* domes in which salt or identifiable cap rock has been encountered by the bit at depths above 5,000 feet and in which the salt has penetrated younger beds. These *piercement* domes are distributed as follows: 17 in the Tyler basin of East Texas; 28 in the salt basin of Louisiana; and 45 in the salt basin of Mississippi. One is located across the line in Alabama. These domes occur in a rather narrow basin 30 miles in width and 120 miles in length in East Texas and 30–60 miles in width and extending across the entire width of southern Mississippi and northern Louisiana.

In East Texas there are 10 *deep-seated* domes interspersed throughout the basin among the *piercement* domes. This holds true for the distribution of 9 *deep-seated* domes in Louisiana and 17 *deep-seated* domes in Mississippi. These deep-seated features differ from the *piercement* domes inasmuch as the salt has not penetrated the beds younger than Lower Cretaceous and has uplifted the overburden in a domal structure giving all the unpenetrated reservoir beds adequate structural relief to make ideal traps for the accumula-

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

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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