Methods of effecting these ends include: (1) using physical measurements of larger rock units than cores, e.g., velocity surveys; (2) figuring back in time to date the epochs of diagenesis, of folding, and of fluid migration, and (3) predicting pressure reduction effects on sediments, to preclude production losses and extra costs, such as at Wilmington, California, described last March by U. S. Grant.

This topic is a concrete phase of concurrent geologic-geophysic deductions, which seem to have been applied too meagerly in the past to development programs to assist cutting costs.

Similar applications are indicated for water production.

Oil Accumulation Related to Geologic History of Muenster Arch and Associated Basins in North Texas

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The chief geologic asset of the region is the thick sedimentary section of Ordovician and Pennsylvanian deposited on the flanks and adjacent to the Muenster arch in the Marietta and Fort Worth basins. These beds contain ample reservoir rocks and abundant source materials for petroleum and natural gas. The dominance of progressive onlap over the arch during the majority of Pennsylvanian time is the second most important feature.

A third important factor is the orogenic history. The extensive and complex faulting may be ascribed to four dominant periods of movement.

1. There was widespread block faulting of probable late Morrowan age, associated with the transformation of the Arbuckle sedimentary basin into partly separated troughs.

2. After erosion had truncated the Ordovician deeply on the Muenster arch and even on fault blocks now low in the adjacent basins, subsidence allowed the Dornick Hills (Bend) beds to overlap the fault blocks with subsequent and sometimes contemporary rejuvenation of some of the faults. (On the northeast flank and in the Gordonville trough area, normal sands were deposited on buried hills like the Sherman and Big Mineral highs and as updip pinch-outs like Sadler field. On the southwest side of the uplift in the Fort Worth basin, beds of this early transgression contained numerous lenses of conglomerate which are prospective for oil and gas in most any structural situation.)

3. Uplift of the Ouachitas, regional westward tilting, tremendous subsidence of the Marietta basin, Gordonville trough, and to less extent, the Fort Worth basin, produced foundering of grand proportions along the trough margins. The long period of progressive inundation of the Muenster arch and its final burial by detritus, chiefly derived from the Ouachita uplift on the east, was probably responsible for much of the oil accumulation in the abundant Pennsylvanian sands. Many stratigraphic traps were formed due to the lenticularity of the sands and updip porosity terminations, where structure may play only a minor role in accumulation. Some of these onlapping beds likewise seal the truncated edge of the Oil Creek (Simpson) sand on the north flank of the arch, where aided some by faulting, three commerical accumulations have been found.

4. A final period of folding and faulting took place during the late Pennsylvanian-Arbuckle compressional movement which resulted in overturning and thrusting in some places. Oil accumulation at Big Mineral and Sherman was aided considerably by this crustal movement.

Petroleum Geology of Anahuac and Frio Formations of Northeastern Mexico

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During the past 14 years, Petroleos Mexicanos has carried on an extensive drilling program. This has been principally concentrated along the Frio-Vicksburg trend. The Frio has been the most prolific producing formation in northeastern Mexico. Of its three facies, non-marine, brackish, and marine, the first named is the most productive.

Locally overlying the Frio, both on the surface and in the subsurface, is the Norma

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-