Production from the Melbourne in Matagorda and Calhoun Counties is trapped primarily in closures against the upthrown sides of down-to-the-coast faults. In contrast, anticlinal closures, located on the downthrown sides of down-to-the-coast faults, form the primary traps through Aransas, San Patricio, and Nueces Counties.

A case history of the South Copano Bay field illustrates basic exploration techniques that are useful in exploring for buried depositional-type structures.

8. DERRELL A. SMITH, Shell Development Company, Houston, Texas

SEALING AND NON-SEALING FAULTS

Differentiating between sealing and non-sealing faults and their effects in the subsurface is a major problem in petroleum exploration, development, and production. The fault-seal problem has been investigated from a theoretical viewpoint in order to provide a basis for a better understanding of sealing and non-sealing faults. Some general theories of hydrocarbon entrapment are reviewed and directly related to hypothetical cases of faults as barriers to hydrocarbon migration and faults as paths for hydrocarbon migration. The phenomenon of fault entrapment reduces to a relationship between (1) the capillary pressure and (2) the displacement pressure of the reservoir rock and the boundary rock material along the fault. Capillary pressure is the differential pressure between the hydrocarbons and the water at any level in the reservoir; displacement pressure is the pressure required to force hydrocarbons into the largest interconnected pores of a preferentially water-wet rock. Thus the sealing or non-sealing aspect of a fault can be characterized by pressure differentials and by rock-capillary properties.

Theoretical studies show that the fault seal in preferentially water-wet rock is related to the displacement pressure of the media in contact at the fault. Media of similar displacement pressure will result in a non-sealing fault to hydrocarbon migration. Media of different displacement pressure will result in a sealing fault, provided the capillary pressure in the reservoir rock is less than the opposing boundary displacement pressure. The trapping capacity of a boundary, in terms of the thickness of hydrocarbon column, is related to the magnitude of the difference in displacement pressures of the reservoir and boundary rock. If the thickness of the hydrocarbon column exceeds the boundary trapping capacity, the excess hydrocarbons will be displaced into the boundary material. Dependent on the conditions, lateral migration across faults or vertical migration along faults will occur when the boundary trapping capacity is exceeded. Application of the theoretical concepts to subsurface studies should prove useful in understanding and in evaluating subsurface fault seals.

9. J. A. GILREATH, Schlumberger Well Surveying Corporation, New Orleans, Louisiana

LOG CHARACTERISTICS OF DIAPIRIC SHALES

High-pressure diapiric shales, commonly associated with domal structures along the Texas and Louisiana Gulf Coast, characteristically exhibit low values of resistivity, density, and acoustic velocity. Thus, well logs enable identification of these intrusive shale masses.

However, deep-water marine shales—of the types which are source beds for diapiric shales—also are high-pressure formations. These shales, in normal stratigraphic positions, exhibit log characteristics which are similar to those of diapiric shales. Therefore, although resistivity, density, and acoustic-velocity logs may indicate that a domal shale core may have been penetrated, additional data are required for confirmation.

Dipmeter surveys provide information to confirm or deny the intrusive nature of the shale. In addition, if the shale is found to be intrusive, dip information locates the well position with respect to the apex of the diapir. As the shale diapir is approached from above, dips (away from the apex) increase in magnitude—just as if a salt dome were being approached. Within the low-resistivity shale, the dips are relatively constant in both magnitude and azimuth, and dips approximate the dip of the contact between the bedded formations and the diapiric shale. This consistent dip within the domal core is distinctly different from the random dips found in gouge shale adjacent to piercement salt domes.

In an offshore field, resistivity values were used to map the top of a shale dome. None of the wells drilled on this structure penetrated salt. The deepest penetration into the domal shale was approximately 2,000 ft. Contour lines were drawn, using as a datum the depths where the various wells encountered a decrease in shale resistivity to 0.5 ohm-meter. The map indicates a minimum structural closure of 6,000 ft. Dips computed from the map agree closely with those measured within the domal shale by dipmeter surveys.

10. ROBERT S. DOLLISON, Pan American Petroleum Corporation, Houston, Texas

BIG HILL FIELD, JEFFERSON COUNTY, TEXAS

Big Hill field is in the Frio sand trend on the western flank of the Big Hill salt dome. Multiple reservoirs in Miocene and Oligocene sandstones are on the downthrown side of a regional, up-to-the-coast growth fault across which early Miocene and older sediments increase in thickness by 57%. One reservoir in the Oligocene Hackberry is bounded by two growth faults and an unconformity (Hackberry unconformity). The hydrocarbons trapped in this reservoir evidently were generated within the surrounding rocks. An isopachous map of the interval between the top of the Frio and the Hackberry unconformity indicates that growth of the Big Hill salt dome occurred prior to the close of Frio time, and that the crest of the dome was north of the present-day salt spine. This map also suggests the presence of a buried, down-to-the-coast growth fault which traverses the western flank of Big Hill field but which does not intersect any wells.

Pressure-performance histories of two reservoirs and of two wells producing from other reservoirs are shown graphically in order to illustrate the problems involved in explaining wells that are in pressure communication. Four gas-fluid contacts in a continuous *Marginulina* sandstone reservoir differ in elevation by 600± ft. These original gas-fluid contacts were established by the migration of hydrocarbons into a complexly faulted area. Accumulation of oil downdip from these gas-fluid contacts can be explained reasonably in terms of gravity-segregation effects.

11. JAMES P. SPILLERS, Louisiana State Mineral Board, Baton Rouge, Louisiana

DISTRIBUTION OF HYDROCARBONS IN SOUTH LOUISIANA BY TYPES OF TRAPS AND TRENDS—FRIO AND YOUNGER SEDIMENTS

INTRODUCTION

Since Frio time, the south Louisiana part of the Gulf Coast geosyncline has been characterized by regressive sedimentation, progressive southward and eastward shifting of successively younger depocenters, southward