no uplift, and the comparatively short time interval between cutting and filling indicate that erosion was not effected in the subaerial environment; therefore the channel was eroded entirely in the marine environment at a depth greater than 1,500 feet.

Cores from the Rosedale Sandstone exhibit many characteristics analogous to turbidites. Turbidity currents or gravity flows of sediment caused the erosion. Downcutting was facilitated by the poor induration of the lower Fruitvale Shale.

M. N. MAYUGA, Long Beach Harbor Department: Geologic Highlights—Easterly Extension of Wilmington Oil Field

An offshore seismic survey in 1954 revealed a continuous anticlinal structure extending from the presently developed area of the Wilmington oil field easterly to an undetermined area beyond the Belmont Offshore Field. A number of normal faults transverse to the axis of the anticline were recognized. In 1961, the Long Beach Harbor Department Petroleum Division estimated that an oil reserve of approximately 800 million barrels of oil can be recovered under a water-flood pressure maintenance operation in the undeveloped offshore and townlot area of the City of Long Beach. Recent core hole data from eight wells drilled in 1962 in the offshore area showed possible production from five zones (Ranger, Upper Terminal, Lower Terminal, Union Pacific, and Ford). All the stratigraphic units in the developed portion of the field are present in the undeveloped area with possibly some older sediments overlying the basement rock. Based on the core hole information, the reserve estimate was revised to a range of 1.1-billion to 1.5-billion barrels of oil recoverable under a water-flood pressure maintenance operation. A development program is under consideration to produce the townlot and offshore area under a unit plan with drill sites to be provided from four, 10-acre, man-made islands.

RICHARD A. MILLS, Petroleos Hondurenos; K. E. HUGH, consultant, Tegucigalpa, Honduras; D. E. FERAY, Texas Christian University; H. C. SWOLFS, consultant, Huntington, New York: Mesozoic Stratigraphy of Honduras

The Honduras basin is an intracontinental salient of a large marginal geosyncline that borders the southern side of the geanticline which divides northern Central America. During Mesozoic and Cenozoic time, 10,000–25,000 feet of sediments were deposited in the Honduras basin. No thick evaporite deposits have been found, suggesting the geosyncline was an open communication with the Pacific and Atlantic oceans.

The Triassic and Jurassic periods are represented by 3,000 feet of deltaic, littoral clastics. The Lower Cretaceous is composed of 2,000 feet of black, shaly limestones containing oil seeps; 2,500 feet of red clastics; 2,000–6,000 feet of massive rudistid and miliolid limestones; and 2,000 feet of conglomerates and clastics derived from the lower formations.

The Laramide orogeny divided the Honduras basin into the Ulua basin on the west and the Mosquitia embayment on the east. The main trough of the marginal geosyncline shifted south, and 35,000 feet of sediments were deposited in the area of Lake Nicaragua during Upper Cretaceous and Tertiary time.

The Ulua basin received 2,000 feet of Upper Cretaceous and Eocene redbeds and limestones and then remained a positive area during the remainder of Cenozoic time. Compressive folding during the mid-Tertiary Antillean revolution, formed distinct east-west geanticlinal belts. Volcanism, beginning during this period and continuing until recent time, was responsible for the thick cover of flows and tuffs along the Pacific coast of Central America.

The Mosquitia area of northeast Honduras and northern Nicaragua became a major embayment during Upper Cretaceous and Tertiary time. Thirteen hundred feet of Upper Cretaceous limestones and shales and 15,000 feet of Tertiary flood-plain and marine clastics underlie the broad Mosquitia continental shelf and extend eastward into the Caribbean Sea 150 miles.

The Pliocene-Pleistocene Cascadian orogeny was responsible for the present-day topography of northern Central America. Wrench fault tectonics probably explain the complex structure of this region.

H. W. OLIVER and D. R. MABEY, U. S. Geological Survey: Regional Gravity Anomalies in Central California

A Bouguer gravity map of central California east of the Coast Ranges has been compiled from over 11,000 observations made by the U. S. Geological Survey, the U. S. Naval Ordnance Test Station, and several oil companies. The Bouguer reductions are based on a rock density of 2.67 g/cm^3 and include terrane corrections in all mountainous areas.

Regional gravity lows in the west and south parts of the San Joaquin Valley are produced by a maximum estimated thickness of more than 30,000 feet of Upper Cretaceous and Cenozoic deposits. Gravity lows also occur over local basins south and east of the Sierra Nevada which, in conjunction with limited seismic refraction measurements, indicate the following maximum thicknesses of Cenozoic deposits: Mono Basin and Long Valley—18,000 feet; Death Valley and Cantil Valley—10,000 feet; Owens Valley—9,000 feet; Indian Wells Valley—8,000 feet; Searles Basin, Saline Valley, and Panamint Valley—3,500 feet.

Bouguer gravity values corrected for the effect of the Upper Cretaceous and Cenozoic deposits show a broad, asymmetrical gravity low centered over the eastern Sierra Nevada with the steepest gradients and greatest relief on the west side. This major anomaly disturbs the earth's gravity field from the western San Joaquin Valley to the California-Nevada border. It can be explained by isostatic compensation of the Sierra Nevada and high areas to the east plus the relatively low-density rocks of the Sierra Nevada batholith.

A gravity ridge that extends for several hundred miles along the east side of the San Joaquin Valley shows excellent correlation with a similar magnetic ridge, suggesting that both anomalies are caused by a dense, magnetic mass buried at an estimated depth of 5–10 miles. This depth approaches the approximate 12 mile thickness of the earth's crust under the valley indicated by seismic refraction measurements.

SAMUEL A. PATTERSON, Security-First National Bank: Economic Trends in California Oil Industry

This is an over-all look at our local industry, relating historical trends with current conditions and generalized forecasts of the future.

District V is no longer isolated from the rest of the United States, but is an integral part of the total international oil industry. Our competitive position in this industry is not expected to deteriorate further.

Radical changes in the make-up of our local industry will take place. Secondary recovery and well stimulation operations will become increasingly important as onshore exploration declines. Large numbers of technical people so oriented will be required.

The independent producer's situation will not improve, and his role in the industry will diminish. All operators will need to increase efforts to cut costs and increase efficiencies. True professional management will develop.

While Administration's new tax proposals may adversely affect profits, we can expect our favorable local market for petroleum products to stimulate and maintain a high level of operations.

LOWELL E. REDWINE, consulting geologist: Morphology, Sediments, and Geological History of Basins of Santa Maria Area, California

This basin study includes several, elongate, in places deep, structural basins trending northwesterly to westerly, as shown on the pre-Tertiary "basement" contour map. Large faults trend similarly. Cross sections suggest that these faults and others as yet unknown or incompletely known probably have brought different basin segments into their present juxtapositions by lateral slip. True *paleogeologic* reconstructions of basin conditions thus would require complex palinspastic restorations. Lacking these, we can trace basin history only crudely with the aid of *subcrop* maps representing pre-Vaqueros, pre-Pt. Sal, pre-Monterey, and pre-Sisquoc time. Suggested depositional environments progressed from above sea-level in the Oligocene to water depths of more than 4,000 feet in Lower Miocene, 1,000 feet to 1,500 feet in Middle and Upper Miocene, 1,500 feet to sea-level in Pliocene, to above sea-level in Pleistocene. Miocene cherty oil reservoirs probably are genetically related to diatomite deposited under conditions possibly similar to those now found in the Gulf of California. Tracing cherty and other reservoir facies probably requires true paleogeologic analysis. Until sufficiently sophisticated geological studies of one of California's oldest producing areas are available, the currently fashionable view that onshore California offers little for economic oil exploration is at best premature.

SARGENT M. REYNOLDS and SARGENT T. REYNOLDS, consulting geologists: Midland Fault, an Eocene Subsurface Fault, Delta area, California

The Midland fault can be traced in the subsurface about 30 miles from the Bunker gas field southward through the Rio Vista field. This steeply dipping normal fault has a maximum vertical displacement of 3,000 feet, all movement occurring between late Paleocene and early Oligocene time. Up to 2,000 feet of Meganos, present on the downthrown western side, is absent on the eastern side. This earliest movement was contemporaneous with deposition or occurred during the post-Meganos pre-Capay regional uplift and tilting. Intermittent movement was contemporaneous with Capay and Domengine deposition, with greater thicknesses being deposited on the downthrown side. There has been a maximum of 600 feet of post-Domengine pre-"Markley" Gorge (Oligocene?) movement. Many gas accumulations of the area are modified or controlled by the Midland and adjacent smaller faults.

KELVIN S. RODOLFO, Allan Hancock Foundation, University of Southern California: Suspended Sediment in Southern California Waters

The South Coastal area of California includes all basins draining into the sea between Rincon Creek (Ventura County) on the north and the American part of Tia Juana Basin on the south, about 28,500 square kilometers. Annual runoff over the past three decades, and suspended load of the 1961–1962 season were determined for the Los Angeles, San Gabriel, and Santa Ana basins, 10,000 square kilometers constituting 35 per cent of the South Coastal area. Extrapolation suggests that 700,000,000 cubic meters of water with a suspended and dissolved load of 2,760,000 metric tons (2,760,000,000 kilograms) is supplied annually to the ocean by southern California. Approximately 580,000 tons coarser than 64 microns forms beach and nearshore sediment. Estimated 1,640,000 tons, coarser than 1 micron, are dispersed widely over the continental shelf and beyond. The remaining 540,000 tons finer than 1 micron could not be analyzed by existing techniques. Centrifuge concentration of marine waters and optical counts of mineral particles reveal fairly uniform suspension values of several milligrams per liter close to shore, decreasing to several tenths of a milligram at the shelf edge 70 miles offshore. Suspension grain sizes parallel this trend, grading from coarse silt nearshore to fine silt and clay at the shelf edge.

ANTONIO GARCIAS ROJAS, manager of exploration, Petroleos Mexicanos: Petroleum Geology of Baja California, Mexico

The Peninsula of Lower California forms a geographical and geological unit which extends south of the westernmost limit of the Mexican-U. S. border.

Granite outcrops in most of the northern part of the Peninsula, but there are narrow belts of sedimentary rocks, of Tertiary and Cretaceous age, which do not present oil possibilities (the Cretaceous rocks show, in general, metamorphism of varying degree).

South of the 28th parallel, which crosses the Sebastian Vizcaino Gulf, most of the area is covered by volcanic rocks, mainly pyroclastics, but a well defined geosyncline is found on the western part of the Peninsula, with important developments of marine sedimentary rocks of Tertiary and Cretaceous age.

Based on the existence of these marine sediments, the oil and gas possibilities of the Peninsula have been studied, but no oil or gas seepages have been found, and although a total of 13 wells with depths ranging from 1,400 to 9,500 feet have been drilled, only one had important gas shows.

Present status does not encourage an intensive exploration program, but it is believed that more work will be done when other areas, with better oil or gas prospects, begin their decline.

FREDERICK L. SCHENCK, Robert H. Ray Company, Division of Mandrel Industries: Delineating Low-Velocity Lenses

The end of a low-velocity lens diffracts energy emerging after reflection at a lower level. Conventional interpretive treatment of such energy as an undiffracted reflection could lead to serious inferences of non-existent structure. Constant moveout down the record is the main criterion for the diffracted reflection situation. The diffractive source, assuming the velocity in the surrounding material to be known, is found as the envelope of emergent travel paths. Reflected energy from the top of the feature, if recognized, can be solved for delineating the upper limit of the body. The thickness can be estimated from observed delay times. For discovering and delineating low-velocity lenses, long reflection spreads should be used.

FREDERICK L. SCHENCK, Robert H. Ray Company, Division of Mandrel Industries: Refraction Solutions by Wavefront Targeting

Emergent wavefronts can be developed from travel time data when the velocity is known by applying