silver, gold, and copper ore are found in mineralized zones in the Goodsprings dolomite. Building stone has been quarried from the Aztec sandstone and limestone from the Monte Cristo limestone. A nominal water supply, sufficient for domestic use, is available at Valley Wells Station, Windmill, Clark Mountain Station, the Mountain Pass Mine, and Wheaton Springs.

(5) GEOLOGY AND OIL IN VENTURA BASIN EAST OF SAN GABRIEL FAULT
Otto Hackel and Roy W. Turner, Intex Oil Company

The discovery in August, 1957, of a small commercial oil field in the Ventura Basin east of the San Gabriel-Palomas Canyon fault trend has led the industry to increased interest and a flurry of exploratory activity in this area. The sedimentary rocks of the region, also a topographic basin, are bounded on the north, east, and south by mountainous masses of pre-Tertiary igneous and metamorphic rocks. On the west the area is delineated by the San Gabriel-Palomas Canyon fault trend beyond which, to the west, lies the main part of the Ventura Basin.

The oldest rocks of the sedimentary sequence are Paleocene marine clastics exposed against the northern basement mass. Uncomformably overlying the Paleocene strata is the fluviatile Oligocene Vasquez formation. Above the Vasquez with unconformable relation the Mint Canyon group of fluviatile and lacustrine origin was deposited during early to late Miocene time. A subsequent invasion of the sea from the west led to the deposition of the Modelo(?) (Castaic formation). In outcrop the Modelo(?) unconformably overlies the Mint Canyon, while along the southwest edge of the area subsurface evidence suggests interfingering with the Mint Canyon. To the north, the Modelo(?) section grades to the overlying basal part of the Ridge Basin group. Following a period of erosion, the southwest part of the area was encroached upon by Pliocene seas to deposit the Pico formation. At the edges of this Pico sea there were contemporaneously deposited the fluviatile sediments of the Saugus formation. Later in Pliocene time the sea retreated westward and the non-marine Saugus rocks blanketed the area. Prominent post-Saugus Pleistocene to recent terrace deposits are found along the main drainages and the intervening ridges.

The part of the area occupied by sediments is a broad westerly plunging syncline which has several smaller folds superimposed upon its flanks. Nearly all the anticlines plunge west or northwest with areas of critical east closure rare and insignificant. Faulting is most prominent in the pre-Miocene formations and is developed in a northeast-southwest system between the San Andreas and San Gabriel major faults. The San Gabriel-Palomas Canyon fault trend involves beds as young as Pliocene and, during a part of the Miocene, it appears to have acted as a barrier or sill to deposition.

Approximately 125 wildcat wells have been drilled in the 132 square miles of area covered by the Mint Canyon-Modelo(?)-Saugus outcrops. Of the above, 50 wells tested only the Mint Canyon formation; 50 wells tested primarily the Modelo(?) strata; and 25 wells were tests of the Pico-Saugus section. To date, one small field (Tapia) has established commercial production in the area. This field is a stratigraphic trap in as and of that part of the Saugus beds equivalent to the downdip Pico formation. Sub-commercial production has been obtained from the Modelo(?) in the Elizabeth Lake Canyon area and on the eastern edge of the Honor Rancho field. A small amount of oil has recently been obtained from Mint Canyon beds in the Bouquet Canyon area, and this formation has also demonstrated low-volume gas in several locales.

(6) GEOLOGY OF CORONA SOUTH QUADRANGLE
Cliffton H. Gray, Jr., California State Division of Mines

The Corona South Quadrangle lies in the northern part of the Peninsular Ranges. It contains the northwest end of the Elsinore trough which marks the trace of the Elsinore fault zone and trends northwestward across the center of the quadrangle. The Chino fault diverges north-northwestward from its apparent junction with the Elsinore fault near the eastern margin of the quadrangle.

The oldest rocks, those of the Triassic Bedford Canyon formation, are meta-sedimentary in character, and occur mainly in the Santa Ana Mountains southwest of the Elsinore fault. Here they have been intruded by late Mesozoic plutonic rocks of the Southern California batholith and in a few places are unconformably overlain by Jurassic(?) volcanic rocks. Northeast of the Elsinore fault is a succession of sedimentary rocks, several thousand feet thick, which includes rocks of Upper Cretaceous through Quaternary age. These units are of types found on the west in the Los Angeles Basin.

The dominant structural features are the Elsinore and Chino zones of high-angle reverse dip-separation faults and a synclinal trough which extends from the Puente-Chino Hills southeastward beyond Corona and lies nearly parallel with and northeast of the Elsinore fault. The surface distribution of Cretaceous sedimentary rocks indicates a probable minimum vertical displacement of 1,500 feet along the Elsinore fault southwest of Corona, whereas on the southeast a displacement of more than 5,000 feet is suggested by the difference in elevation of the basement complex on opposite sides of the fault. In post-Pliocene time, and perhaps throughout their history, the Elsinore and Chino fault zones have had an apparent high-angle reverse sense of movement. Large lateral displacement is not demonstrated in the mapped area. In the Corona area the Elsinore trough is probably a faulted syncline.

Mining operations, especially for clay, crushed and broken stone, and glass sand, have been

carried on since the late nineteenth century. Repeated though unsuccessful attempts have been made to find petroleum.

Records indicate 15 wildcat oil wells have been drilled within the quadrangle since 1925. Of these wells, 12 were put down in the period 1949–56. Several wells may have encountered non-commercial gas and oil shows, but there has been no sustained production.

(7) Financing of Future Exploratory Companies
R. G. Greene, Great Basins Petroleum Company

It is assumed that the spirit of free enterprise in the United States will provide favorable environment for the formation of many new oil and gas companies in the years ahead. It is further assumed that many petroleum geologists and engineers have or will develop the desire and ambition to play the part of entrepreneurs in the oil and gas industry. The contents of this paper should prove helpful to a majority of technical men whose experience in public financing is limited.

(8) Oil Basins of Peru
Irving T. Schwade, Richfield Oil Corporation

The principal oil basin of Peru, confined between the Andes and the Pacific Ocean, is a part of the long narrow belt (750×50 miles) of chiefly marine Tertiary sediments extending from northern Peru to western Colombia. Oil is produced on the Talara-Negritos, Lobitos, and El Alto uplifts from innumerable normal fault traps, which appear to have developed due to differences in basement density and/or rigidity rather than tectonic folding. The faults reflect the persistent tensional stress which prevailed from early Tertiary to early Quaternary. The area produces about 50,000 b/d of 37° gravity oil; cumulative production to date is about 600 million barrels.

The other oil-producing area of Peru is the heavily jungle-covered, scarcely explored Maranon Basin, which occupies the upper Amazon tributary drainage east of the Andes. This basin is a part of the sub-Andean trough, an elongate downwarp which persists from eastern Venezuela, through eastern Colombia, Ecuador, Peru, Bolivia, into western Argentina, lying between the overriding Andean uplift and the Guiana and Brazilian shields. The basin contains up to 12,000 feet of Tertiary and Quaternary fluviatile and lacustrine sediments which mask the Mesozoic and upper Paleozoic objectives. From outcrops and seepages in the Andean foothills, these objectives should constitute substantial reservoir and source rocks. The Ganso Azul and recently discovered Maquia fields, lying on the southwestern margin of the Maranon Basin in the belt of surface folds, are the only producing structures in the basin to date, with a daily production of less than 3,000 barrels, and an ultimate yield of probably less than 15 million barrels.

Attention is directed to the many geological similarities exhibited by North and South America in structural framework, tectonics, paleogeography, and stratigraphy.

(9) California Offshore Oil, Present and Future
Francis J. Hortig, California State Land Commission

1. A general historical review of California coastal tide and submerged land development starting with the first tideland well in 1896.

2. General review of past production, locations, techniques, and magnitude—which have totalled 312,000,000 barrels and $126,000,000 State-lease royalty payments through December, 1957.

3. Summary of present problems in future leasing and development. Suggestions as to future requirements and some possible development techniques.

(10) Eocene Gorge in Northern Sacramento Valley
J. D. Frick, T. P. Harding, and A. W. Marianos, Humble Oil and Refining Company

A prominent erosion-and-fill feature has been observed in the subsurface of the Sacramento Valley in Northern California. The feature, which has been termed a "gorge," extends for approximately 40 miles along a narrow, sinuous trend that is generally parallel with the course of the Sacramento River.

As much as 2,000 feet of Upper Cretaceous section has been removed by erosion and the trough later filled with sediments that have been correlated with the Eocene B-2–B-4 zones of Laiming.

It is suggested that submarine erosion of this thick section of Upper Cretaceous deltaic sediments was initiated by the uplift of adjacent land areas with consequent rejuvenation of the stream. A filling of the trough was started as the sediments built up on the basin floor and the marginal landmass had been reduced by erosion. Foraminifera, as well as certain textural features of the sediments, indicate that the entire sequence was laid down in a marine environment. There is no evidence in the fill or in the underlying beds that subaerial processes were involved.

This feature is important in exploration in that natural gas is present in sediments within the "gorge" as well as being trapped in Cretaceous sediments truncated by the "gorge."

(11) Geologic Reconnaissance of Alturas Area, Northeastern California
T. E. Gay, Jr., and Q. A. Aune, California State Division of Mines

To augment the California Division of Mines State Geologic Map project, photogeologic map-