numerous fragments of older intrusive rocks and an older metasedimentary series (Placerita) of possible Paleozoic age. The range is flanked on the north by a thick series of continental sandstones and conglomerates, interbedded with volcanics, of probable Miocene age. Intensely folded and faulted marine Pliocene sediments and continental lower Pleistocene gravels lie on the crystalline rocks along the southwest border of the range. Marine Paleocene Martinez sandstone and conglomerate occur in slivers in the San Gabriel fault zone.

In the Peninsular Ranges, rocks of the Lower Cretaceous (?) batholith are exposed, including principally granodiorite, tonalite (quartz diorite), and gabbro. In general, these plutonics have intruded Triassic and Jurassic (?) sediments and volcanics along their western border, and Paleozoic sediments along the eastern border. All pre-Cretaceous formations have been metamorphosed to some extent and are widely distributed through the areas of plutonic rocks. Upper Cretaceous sediments overlie the basement crystalline rocks near the northwestern end of the Santa Ana Mountains and in the Southern Coastal region. Marine and brackish-water sediments of the Paleocene Martinez formation are distributed along the Elsinore fault zone. Continental Miocene sediments and volcanics are found along the San Andreas and San Jacinto fault zones and in the bordering Coachella and Imperial valleys at the east.

Evidences of oil and gas have been found only along the margins of the crystalline rock masses, particularly abundant at the western and southwestern borders of the San Gabriel Mountains where there are numerous seepages. A very small amount of high-gravity oil was produced at the turn of the century from several shallow wells in crystalline rocks in the San Gabriel fault zone in the western San Gabriel Mountains 2½ miles east of Placerita oil field. Of a total of more than 70 exploratory wells drilled in the Southern Mountain region, these are the only ones which had any real shows of oil or gas.

12. IMPERIAL VALLEY

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The marine and continental sediments which occur in Imperial Valley may be divided into the following formations.

1. Split Mountain formation: Miocene (?) marine and continental sediments.
2. Alverson Canyon formation: Miocene (?) non-marine sediments and associated volcanic flows.
3. Imperial formation: Miocene marine sediments.
4. Palm Spring formation: Miocene and/or Pliocene marine and non-marine sediments.
5. Borrego formation: Lower Pleistocene (?) non-marine sediments.

Surface and well data indicate that at least 14,000 feet of sediments were present west of Salton Sea at the end of deposition of Borrego formation and as much as 25,000 feet of sediments may be present in the central part of Salton Sink.

Structurally Imperial Valley is a series of parallel fault blocks. The general trend of the major faults is N. 55° W. Two of these faults which are well known and extend beyond Imperial Valley are the San Jacinto and San Andreas. The sediments have two structural alignments, one sub-parallel with the major faults and the other trending east-west.

On the basis of surface data the possibility of obtaining commercial quantities of natural gas or crude oil appear to be very meager. Although a composite section of 22,000 feet of sediments is exposed at many places in the western part of Imperial Valley, only 3,600 feet are of definite marine origin. The writer has observed no indication of petroleum except for small quantities of methane gas, comparable to that in many present-day swamps, in the non-marine sediments of the Palm Spring and Borrego formations.

13. EASTERN MOUNTAIN AND DESERT REGION

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That part of California east of the San Andreas rift and east of the western edge of the Sierra Nevada has been consistently ignored as a possible future oil province. Nevertheless, the subdivision of the region north of the Garlock fault and east of the Sierra Nevada is worthy of some attention by petroleum geologists.

About 40,000 feet of sediments in the region range in age from pre-Cambrian to Quaternary, with most periods represented. Structural deformation is generally complex, but regional metamorphism is lacking. An oil seep is known from Paoha Island in Mono Lake. In general, geologic conditions are similar to those in northeastern Nevada where there is currently an active exploratory program.

The principal factors which would assist exploration in this region are the concepts of discovery-thinking prevalent among geologists in the Mid-Continent and in the Rocky Mountains. Carbonate rocks may be source beds and also reservoirs; the general regional geology concerns features of basins superimposed upon geosynclines; lateral continuity is prevalent; saturated zones may be thin; structural deformation largely concerns competent strata.