WHITTIER
FAULT ZONE

View southeast along the Pomeroy/Chino Hills toward the Santa Ana Mountains (right distant). The Whittier fault area, left of the rectangular mosque-like top of ridge, middleground, slices through Pleistocene and Miocene marine sedimentary rocks, and is the dominate structural feature in the Bear-Olinda oil field area. Production from this field has amounted to more than 267,000,000 barrels (1/3 the largest producing field in California), from more than 1,000 wells. Photo by R. C. Frumpus and J. S. Smother, 1966.

BANNING-MISSION
CREEK FAULT

Vertical aerial photograph of the fault-bounded Indo Hills, in the Cucamonga Valley. The Banning-Mission Creek fault, part of the late Andean fault zone, is extensively linear and marked by well developed scarps. Numerous alluvial plain deposits, rocks in the Indo Hills include well-bedded Pleistocene sandstone and shale and poorly-bedded Pleistocene conglomerates. Photo from C. X. Department of Agriculture, 1911.

ELSIMORE
FAULT ZONE

High altitude view (from approximately 1600 feet), toward the southeast along part of the Elsinore fault zone, from Corona and the Santa Ana Mountains (foreground), across Lake Elsinore (middleground), to Agua Tibia Mountain (background). Sedimentary rocks in the foreground contrast the form of the Corona alluvial fans. Photo by R. C. Frumpus, 1946.
<table>
<thead>
<tr>
<th>AGE</th>
<th>STATE MAP SYMBOL</th>
<th>STATE MAP UNIT</th>
<th>STRATIGRAPHIC UNITS AND CHARACTERISTIC LITHOLOGY</th>
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<tbody>
<tr>
<td>Qs</td>
<td>RECENT DUNE SAND</td>
<td></td>
<td>Worked sands and, local dunes.</td>
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<tr>
<td>Qol</td>
<td>RECENT ALLOUVUM</td>
<td></td>
<td>Unconsolidated silt, clay, and ash.</td>
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<tr>
<td>QL</td>
<td>QUATERNARY LAKE DEPOSITS</td>
<td></td>
<td>Deposits of Lake California—clay, silt, sand, and, in places, lowland fluviatile sands.</td>
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<tr>
<td>Qt</td>
<td>QUATERNARY NORMATIVE TERRESITUS DEPOSITS</td>
<td></td>
<td></td>
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<tr>
<td>Qg</td>
<td>QUATERNARY GLACIAL DEPOSITS</td>
<td></td>
<td>Deposits of glacial outwash and delta deposits of the present Paracale and lower Paracale Flats.</td>
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<tr>
<td>Qm</td>
<td>PLEISTOCENE MARINE AND MARINE TERRESITUS DEPOSITS</td>
<td></td>
<td>Glaciated rock debris, clay, and silt.</td>
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<tr>
<td>Qc</td>
<td>PLEISTOCENE NORMATIVE TERRESITUS DEPOSITS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qv</td>
<td>PLEISTOCENE VOLCANIC ROCKS</td>
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<td>Basaltic</td>
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<td>S</td>
<td>QUATERNARY CINDER CONES</td>
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<tr>
<td>QP</td>
<td>PLEISTOCENE NORMATIVE TERRESITUS DEPOSITS</td>
<td></td>
<td>Glacial till and fluviatile sands, locally with clay and silt.</td>
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<tr>
<td>Pc</td>
<td>UNDIVIDED PLEISTOCENE NORMATIVE TERRESITUS DEPOSITS</td>
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<td>Pml</td>
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<td>Muc</td>
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<td>Tertiary nonmarine clastics, sandstones, mudstones, and siltstones</td>
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<td>Tertiary lake deposits</td>
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<td>IV</td>
<td>TERTIARY INTENSIVE (HYPSIDYAL) ROCKS</td>
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<td>Tertiary volcanic rocks</td>
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<td></td>
<td>UPPER OCEANIC MARINE SEDIMENTARY ROCKS</td>
<td>Upper oceanic marine sedimentary rocks</td>
</tr>
</tbody>
</table>

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**MERODIO GRANITIC ROCKS**

- Undifferentiated granniic rocks
- Granite and adamellite (quartz monzonite)
- Granodiorite
- Tonalite (quartz diorite) and diorite

**MERODIO BASIC INTRUSIVE ROCKS**

- Ultrabasic rocks

**MERODIO ULTRABASIC INTRUSIVE ROCKS**

- Juralus and/or trisal trachybasalt metabasalts

**MERODIO UPPER JURASSIC MARINE SEDIMENTARY AND METAMORPHIC ROCKS**

- Pre-Cretaceous metabasalts
- Cretaceous metabasalts
- Cretaceous granites

**MERODIO NOTES**

1. The type locality of the Permian Formation is in the Tertiary basin. However, the Permian rocks have been extensively studied in the Permian Basin and are known to be of Tertiary age. The Permian Basin is an important hydrocarbon province and is located in the northwestern United States.
2. The Permian rocks are primarily associated with marine environments and are characterized by sandstones, shales, and siltstones.
3. The Permian rocks are important for their role in the formation of oil and gas reservoirs in the Permian Basin.

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**REFERENCES**

4. The Permian rocks are important for their role in the formation of oil and gas reservoirs in the Permian Basin.

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**APPENDIX**

- The Permian rocks are characterized by their age and are associated with the Permian Basin.
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TOPOGRAPHIC QUADRANGLES
WITHIN THE SANTA ANA SHEET
AVAILABLE FROM THE U.S. GEOLOGICAL SURVEY
FEDERAL CENTER, DENVER, COLORADO 80223
1965

ANALYSIS
CORONA
RIVERSIDE
PEBRIS
BANNING
PALM SPRINGS
THOUSAND PALMS
LOST FOREST Mtn.

SANTA ANA
SANTIAGO PEAK

MURRIETA
HEMET

IDLEWILD
PALM DESERT "COACHELLA"

MARGARITA PEAK

PALOMAR Mtn.

CLARK LAKE TRABIT PEAK

OCEANSIDE

ANCIENT SHORELINES

View north from San Onofre (topographic), across Carlsbad Lagoon, south Oceanside and the San Diego Mountains (shelves). Elongate ridges parallel to the shoreline indicate former positions of the shore as the sea receded to relatively recent geologic time. The ridges occur discontinuously for 40 miles from Oceanside to Mexico. From R. C. Emanuel and J. F. Selby, 1964.