Oil and Gas Fields Around Mount Diablo*

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Abstract

Mount Diablo is one of the most dramatic mountains of the Coast Ranges of California. It rises to almost 4000' in elevation and is located at a conspicuous location between the San Francisco Bay and the Great Valley. What many who see this mountain do not know is that it is ringed by oil and gas basins and fields. This paper explores these, including fields in the Livermore Basin south of the mountain and fields of the Sacramento Basin both north and east of it. The tectonic history of the mountain and its effect on basin morphology and hydrocarbon capture and re-capture will be discussed. Topics will include the probable Eocene basin that once had the Livermore and Brentwood fields together, now severed by the mountain, and discussion of the gas fields with multiple thrust sheets on the northern side of the mountain (due to compression of the Suisun Sub-Basin?).

References Cited


OIL AND GAS FIELDS AROUND MOUNT DIABLO

Tim Elam and Scott Hector
PSAAPG Convention, 2018
OIL AND GAS FIELDS

• LIVERMORE BASIN (South)
  • Livermore Oil Field
  • Hospital Nose Gas Field

• SACRAMENTO BASIN
  • Brentwood Oil Field
  • Concord Gas Field
  • East Brentwood Gas Field
  • Los Medanos Gas Field
  • Mulligan Hill Gas Field
  • Willow Pass Gas Field
MOUNT DIABLO

SACRAMENTO BASIN FIELDS ON FOLDS FORMED BY “MOUNT DIABLO TECTONICS”

LIVERMORE BASIN FIELDS IN BASIN FORMED BY “MOUNT DIABLO TECTONICS”
## OIL AND GAS FIELDS BY SIZE

<table>
<thead>
<tr>
<th>FIELD</th>
<th>Oil</th>
<th>Natural Gas</th>
<th>Year Found</th>
<th>Year Abd.</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brentwood</td>
<td>9,300,000</td>
<td>51,100,000</td>
<td>1962</td>
<td>2005</td>
<td>Abandoned</td>
</tr>
<tr>
<td>Brentwood, East</td>
<td>77,000</td>
<td>47,500,000</td>
<td>1978</td>
<td>Shut-In 2016</td>
<td>Shut-in</td>
</tr>
<tr>
<td>Concord</td>
<td>0</td>
<td>3,100,000</td>
<td>1962</td>
<td>1969</td>
<td>Abandoned</td>
</tr>
<tr>
<td>Hospital Nose</td>
<td>0</td>
<td>14,000</td>
<td>1952</td>
<td>1956</td>
<td>Abandoned</td>
</tr>
<tr>
<td>Livermore</td>
<td>1,900,000</td>
<td>0</td>
<td>1967</td>
<td></td>
<td>Producing</td>
</tr>
<tr>
<td>Los Medanos</td>
<td>0</td>
<td>41,000,000</td>
<td>1958</td>
<td></td>
<td>Gas Storage</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Small Prod.</td>
</tr>
<tr>
<td>Mulligan Hill</td>
<td>0</td>
<td>120,000</td>
<td>1961</td>
<td>1968</td>
<td>Abandoned</td>
</tr>
<tr>
<td>Willow Pass</td>
<td>0</td>
<td>6,400,000</td>
<td>1959</td>
<td>2001</td>
<td>Abandoned</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td>11,277,000</td>
<td>149,230,000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MOUNT DIABLO FIELDS – North and East

Suisun Bay Sub-basin and Sacramento Basin

• FIELDS TO THE NORTH
  • Concord
  • Los Medanos
  • Mulligan Hill
  • Willow Pass

• FIELDS TO THE EAST
  • Brentwood
  • East Brentwood
MOUNT DIABLO

SACRAMENTO BASIN FIELDS ON FOLDS FORMED BY “MOUNT DIABLO TECTONICS”

LIVERMORE BASIN FIELDS IN BASIN FORMED BY “MOUNT DIABLO TECTONICS”
Hoffman
Top Domengine

CONCORD GAS FIELD

LOS MEDANOS FIELD

WILLOW PASS FIELD

MULLIGAN HILL FIELD
Figure 5. Southwest-northeast Structure Section C-C', from west of the Concord Anticline through Los Medanos Anticline.
CONCORD GAS FIELD
(DOGGR DATA SHEET)
LOS MEDANOS GAS FIELD (DOGGR data sheets)

FOUND BY GEORGE ROTH AND McCULLOCH OIL in the 1958 – Sold to PG&E for gas storage in the 1975
MULLIGAN HILLS GAS FIELD (DOGGR data sheets)

LOCATED JUST SOUTHEAST OF WILLOW PASS FIELD ON THE SAME ANTICLINAL TREND
WILLOW PASS GAS FIELD (DOGGR FIELD SHEETS)

LOCATED BETWEEN LOS MEDANOS FIELD AND MULLIGAN HILLS FIELD ON THE SAME ANTICLINAL TREND
VIEW OF THE PRODUCTIVE ANTICLINES
LOOKING NORTH FROM MOUNT DIABLO
MOUNT DIABLO – GAS FIELDS EAST OF THE HILL

BRENTWOOD

EAST BRENTWOOD
MOUNT DIABLO

BRENTWOOD FIELDS

SACRAMENTO BASIN FIELDS ON FOLDS FORMED BY “MOUNT DIABLO TECTONICS”

LIVERMORE BASIN FIELDS IN BASIN FORMED BY “MOUNT DIABLO TECTONICS”
BRENTWOOD OIL FIELD
(DOGGR data sheets)
EAST BRENTWOOD GAS FIELD (DOGGR data sheets)
FIELDS SOUTH OF MOUNT DIABLO

FIELDS IN THE LIVERMORE BASIN

WHAT FIELDS ARE LOCATED IN THE BASIN?

THESE FIELDS WILL BE SHOWN ON THE NEXT SLIDE !!!!!
Livermore Basin

FIELDS IN THE BASIN:

1. HOSPITAL NOSE

2. LIVERMORE
MOUNT DIABLO

SACRAMENTO BASIN FIELDS ON FOLDS FORMED BY "MOUNT DIABLO TECTONICS"

LIVERMORE BASIN FIELDS IN BASIN FORMED BY "MOUNT DIABLO TECTONICS"

BRENTWOOD FIELDS
HOSPITAL NOSE

Natural Gas field
Faulted nose trap
Small accumulation
LIVERMORE OIL FIELD (DOGGR data sheets)

FIELD HAS PRODUCED ALMOST 2 MILLION BARRELS OF OIL – STILL HAS A HALF DOZEN WELLS PRODUCING
THE BIG PICTURE ABOUT MOUNT DIABLO – COURTESY OF JEFF UNRUH, et.al.
UNRUH (2007)

GAS PRODUCTIVE ANTICLINES

MOUNT DIABLO

LIVERMORE OIL FIELD
Figure 3. Regional cross sections across Mount Diablo and Tassajara antiflilines (locations shown in Figs. 1 and 2). Estimates of Pliocene burial temperatures and depths from fossil-thermal and (U-Th)/He data were used to reconstruct the now-eroded upper parts of the cross sections.
Figures 5. Shallow cross section drawn through three deep wells drilled in the Tuolumne antiform (wells locations indicated in Fig. 1); data provided courtesy of Chevron. Section illustrates how Eocene strata (EP1) exposed on the forelimb of the Mount Diablo antiform can be traced through the axis of the Tuolumne Valley syncline and die into upper rocks encountered in the Barrow Formation No. 1 well. Cross section highlights abrupt dip-discontinuities in the upper Neogene Tuolumne Formation that may be angular unconformities.

Figures 6. Shallow cross section showing detail along the line of the regional cross sections in Figure 2a. The section presents an interpretation that faults at a low angle to bedding (e.g., the Morgan Territory fault and Marsh Creek fault) are part of a detachment system under-lying the north-trending grabens; the detachment is faulted about the axes of the Mount Diablo antiform. Stratigraphic relations among Cenozoic rocks incident to the antiform axes are consistent with evolution of section by these faults.
STORIES OF MY OWN ON MOUNT DIABLO

1. LIVERMORE OIL FIELD MINERAL REMOTENESS OPINION

2. MULLIGAN HILLS GAS FIELD WELL
LIVERMORE OIL FIELD OPINION

- HOBBY ENERGY HIRED BY LAND OWNER TO DO STUDY
- CAL-TRANS NEEDS TO PRESERVE ENDANGERED SPECIES
- OWNERSHIP OF SURFACE AND MINERALS IS SPLIT
- MINERAL RIGHTS HOLDER INSISTS THE OIL FIELD IS DRAINING HIM
- GEOLOGY STUDY SHOWS NO CHANCE OF OIL IN SAME BEDS AS LIVERMORE OIL FIELD DUE TO STRIKE-SLIP FAULT
- TO SATISFY MINERAL OWNER, HOBBY ENERGY PREPARES DRILLING ISLANDS PLAN
Sweet Ranch located 1 mile south of this area

Greenville oil sands

Thin veneer of Tertiary age rocks

Schematic portrayal of geology in this area from DOGGR
DRILLING ISLANDS AND EASEMENT AREA, SWEET RANCH STUDY
MULLIGAN HILLS GAS FIELD WELL

GOTLAND OIL ACCEPTS PROSPECT FROM ROD NAHAMA

2D SEISMIC DESIGNED AND SHOT FOR JIM MCWHORTER MAKES PROSPECT SMALLER THAN WHEN MAPPED WITHOUT SEISMIC

GOTLAND WELL FINDS GAS PAY, BUT AT UNUSUALLY LOW PRESSURES

GOTLAND’S GEOLOGIST (me) REALIZES THERE ARE AIR SANDS ON TOP OF RIDGE, NOTICES SPRINGS ON HILL SIDE WHERE OAK TREES ARE – WHEN TOP OF WATER ADJUSTED - PRESSURES WERE NORMAL
KELLER #1

Perfs. 2190-2204', 2240'-2252'
618 Mcf/D, 454#/469#
1. The gas Carneros Energy (aka Gotland Oil) found is still there!
2. There is likely no way to get the gas out
3. However, there may be other uses for the gas
4. Tested at over 600 MCF per day!
5. Call Rod Nahama if interested
SUMMARY

1. FIELDS RING MOUNT DIABLO, TO THE NORTH, EAST AND SOUTH

2. MOST OF THE FIELDS ARE STRUCTURALLY TRAPPED

3. THE BRENTWOOD FIELDS HAVE SIGNIFICANT STRATIGRAPHIC COMPLEXITY THAT HELPED TRAP THE OIL AND GAS

4. IT IS UNLIKELY THAT ANY ADDITIONAL FIELDS WILL BE FOUND IN THE MOUNT DIABLO AREA
IS THE SUN SETTING ON THE

OIL AND GAS FIELDS OF MOUNT DIABLO?