History, Geology, and Politics of Livermore Oil*

Alan K. Burnham

Search and Discovery Article #70393 (2019)**

Posted September 9, 2019

*Adapted from oral presentation given at 2019 AAPG Annual Convention and Exhibition, San Antonio, Texas, May 19-22, 2019

**Datapages © 2019 Serial rights given by author. For all other rights contact author directly. DOI:10.1306/70393Burnham2019

1Consultant, Livermore, California (akburnham@yahoo.com)

Abstract

In 1868, a 6.8 or so magnitude earthquake on the Hayward Fault caused a small explosion on a hillside four miles northeast of now downtown Livermore, California, and an oily spring started up 70 meters away. Thus started the 150-year history of oil and gas exploration and production in Livermore. Oil prospecting near seeps is not unique - that was the method of choice in the 19th century. But the link to an earthquake is more unique and reminiscent of the 1960s television show, The Beverly Hillbillies, in which oil was discovered by a stray rifle bullet from a mountaineer. It turns out that Jethro on that show, Max Baer, Jr., is the son of heavyweight boxer champion Max Baer, who grew up in Livermore and has a sports park named after him.

Oil in the Livermore basin was most likely generated about the time of the rise of Mount Diablo about 4 Ma and driven by its resulting erosion and deposition within that basin. Isotopic analysis of the oil indicates an Eocene source rock, variously known as the Nortonville or Kreyenhagen Shale, which is contemporary to coals mined in the Altamont Hills east of Livermore. The source rock was buried to oil generation depths, possibly as early as the Upper Miocene in some locations and possibly as late as the Upper Pliocene in other locations. Only a small portion of California oil is sourced from an Eocene rock (e.g. Coalinga), and the resulting API gravities in mid-twenties to mid-forties were used in the early 1900s to promote Livermore as a topic exploration prospect. Livermore residents at the time thought that discovery of oil was important for the town to prosper.

Despite dozens of wells drilled near seeps and anticlines between 1868 and 1966, only a tiny gas field was found in 1952. Then, between the major seep-inspired sites, a 2-million-barrel oil field was discovered in 1967 near the intersection of the Greenville and Las Positas faults. The reservoir is in the Greenville sands of the Miocene Cierbo Formation at depths of 1000-2000 feet deep.

In 2016, the Alameda County Supervisors were convinced to ban hydraulic fracturing in a symbolic vote that had no impact on the Livermore oil production, because it comes from a conventional reservoir. However, updating of the EPA aquifer exception and county conditional use permits raised additional opposition for a variety of reasons. The Alameda County Supervisors voted in 2018 not to extend E&B Resources’ conditional use permit, and the case is currently being litigated in federal court.
References Cited

http://www.sjvgeology.org/history/gushers.html

Ireland, W., 1988, 8th Report of the State Mineralogist: California State Mining Bureau, Sacramento, p. 25-26.


History, Geology, and Politics of Livermore Oil

Alan K. Burnham
Livermore, CA
Lakeview Gusher, Maricopa, CA, 1910
125,000 bbl/day almost twice Spindletop

Mays Gusher, Taft, CA, 1910

Indiana-Ohio=22
WV=16

Blue Goose Gusher, Oil City, CA, 1898

Old Maud, Santa Maria, CA, 1904

First gusher near Ojai, ~1866
Adams Canyon Gusher, Ventura CA, 1888
Adams No. 28, Ventura CA, 1892
Shamrock Gusher, McKittrick CA, 1896
Silvertip Gusher, Coalinga CA, 1909

http://www.sjvgeology.org/history/gushers.html
Takahashi and Gautier, USGS Paper 1713, 2007
The Beverly Hillbillies

Donna Douglas  Irene Ryan

Buddy Ebsen  Max Baer
Max Baer, Sr.
Grew up on a pig farm in Livermore
Became World Heavyweight Boxing Champion in 1934
Rode in the Livermore Rodeo Parade in 1941

Max Baer, Jr.
Born in Oakland and raised in Sacramento
Jethro Bodine in *The Beverly Hillbillies*
Grand Marshal of 1978 Livermore Rodeo Parade

Intermediate L.L. World Series held at Max Baer Park
Livermore oil prospecting started in 1868 after an earthquake caused an oily spring

The petroleum interests of Alameda County are at present at a standstill, but it is the intention of those concerned in the enterprise to resume operations as soon as suitable arrangements can be made. Petroleum was first discovered in Alameda County on the ranch of Joshua Brown, in S. 26, T. 2 S., R. 2 E., M. D. M., about four miles east from the town of Livermore. At the time of the earthquake in 1868, a subterranean explosion occurred, which displaced large masses of the conglomerate and coarse sandstone formation on this ranch, the rocks being in some places blackened as though large charges of blasting powder had been used. Simultaneously a spring of water commenced to flow about seventy-five yards from the point of disturbance, the waters containing traces of petroleum, and considerable gas rising therefrom. This incident suggested the idea of prospecting for oil and gas, and a drill hole ten feet deep was sunk in the spring. This caused a viscous black oil of the consistency of tar to flow in such quantities that a five-gallon can could easily be filled in two hours. Prospecting was recommenced in 1875, and a well fifty-nine feet deep was bored. Water and petroleum were struck at a depth of forty-five feet, and continued to flow until the hole (which was not cased) caved in. In 1886, a company, under the name of the Alameda Oil and Gas Company, bored a hole a few yards north of the first prospect, and at a depth of about one hundred and sixty-five feet obtained a stream of water and some oil; the well was bored to a depth of two hundred and eight feet, but no increase of either water or oil was recorded. This well still affords a small stream of water, upon the surface of which a little petroleum collects, and inflammable gas is given off in bubbles.

Strata met in boring:

<table>
<thead>
<tr>
<th>Strata</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil</td>
<td>5 feet</td>
</tr>
<tr>
<td>Sand rock</td>
<td>100 feet</td>
</tr>
<tr>
<td>Strata of pebbles as large as peas</td>
<td>43 feet</td>
</tr>
<tr>
<td>Sand rock at finish</td>
<td>208 feet</td>
</tr>
</tbody>
</table>

Immediately above the spring which was opened by the earthquake in 1868, the sand rock can be exposed by shoveling. It dips to the southwest at an angle of about 30 degrees, and is overlaid by a stratum of clay containing carbonaceous matter. The rocks cropping out from the summit of the hills overlooking the spring are conglomerate and coarse sandstone, the formation being so displaced as to destroy all appearance of stratification. A boring was made by the Livermore Oil Company, about eight miles east of Livermore, in the direction of Corral Hollow, to a depth of about three hundred and fifty feet. Prospecting for oil was commenced in this neighborhood several years ago, oil having been observed upon the surface of a spring a few yards southwest from the boring of the Livermore Oil Company. Sandstone and shale upon the west bank of this spring are impregnated with oil. Oil was also discovered at an early day in the Palomares Cañon near Haywards. A small shaft twenty feet deep was sunk in a spring, six miles northeast of that town; salt water and a dark colored oil raised nearly to the top of the well, both of which disappeared after the earthquake of 1868.
This is where it began in 1868, eight years before Livermore was incorporated
Outcrop of San Pablo Group, incl. Cierbo Fm., incl. Greenville Sands

Brown ranch area 1868-1898

I live here

Hamilton Ranch 6 wells 1900-12

French 1911, 1917

Alisal 1909

Standard Oil 1908

Unknown 1900

Daisy 1905

windmills
The casing of the 1912 well is still present
Just upstream are the remains of another well.
And just over the hill from Independence...
Livermore hoped to become another Coalinga

Oil was viewed as being essential for town growth

Both the Alisal and Independence wells were promoted with confidence

Alisal initially produced 5 bbl/day

Livermore Herald & News (1967)

Bitter Disappointment

Livermore Had Hopes For ‘Darling’ Oil Well

By M. R. HENRY
Second Part of a Series

The Alisal was the Livermore favorite of all the wells put down in what was called the “Livermore Oilfield.” “Darling” of “sweetheart” could well be better terms to describe the affection which this well had in the community.

Although not organized here and not originally financed here, actual drilling operations were under control of Livermore men and financed by Livermore capital. It was drilled at the time when hopes were highest, following some nine years of experimental drilling, all of which gave promise. Although not very small — population 2,630 in 1910 — Livermore was progressive and aggressive and wanted to grow faster than it could expect with farming and cattle raising as its principal means of support.

At the time, the very life of the town appeared to depend on striking oil. It is impossible today to make understandable the intense hope which prevailed. The Alisal was looked to as the well which would produce oil, lead to the development of the field and make Livermore another Signal Hill or Coalinga, then the leading oil producing sections. A step in that direction.

Although the oil was not discovered, five barrels a day was used to fire the boilers of W. M. & S., drilled nearby. With it, the dreams of a Livermore oil field faded away, to be followed by skepticism. However, there was always an underlying hope that some day oil would be struck and a field developed. This same hope has persisted to this day on the part of those who experienced the hopes and disappointments of the Alisal and other wells sunk between 1900 and 1947.

The log of the Alisal may be taken as fairly typical of most of the other early wells, but from a drilling standpoint only the manner in which its financing and management were handled. Livermore capital was only a minor factor in the others.

Drillers continually spoke hopefully of the bright prospects as the bit went down, and likewise continually had breaks, lost their tools in the well and suffered delays for many other reasons.

The log as the public knew it is reproduced here from the records of the Livermore Herald, indicative of the anticipation, the eager hope and final bitter disappointment.

Drill on Section 15, Township 3 South, Range 3 East, near the old 15-3 well.

May 29 — Leases on 2,000 acres in Townsend district secured.

June 10 — Test well is started.

July 24 — Test drilling completed, finding oil sand at shallow depth.

Aug. 7 — Contract let with G. S. Mendenhall as driller. Work to start with Keystone rig but all standard outfit to be used when well reached depth of 1,000 feet. Casing to be 14 inches in diameter to start.

Sept. 4 — Drilling at 75 feet. Oct. 23 — Oil-bearing shale to calculated at 250 feet.

Jan. 15, 1910 — Work retarded by lack of funds. Livermore men being interested in company to secure capital. W. J. Connell, high school principal H. B. Varney, banker, and H. P. Winagar, merchant, all of Livermore to act as directors.

Jan. 21 — Livermore people in full control. M. G. Callaghan, insurance man and later postmaster, elected secretary.

Feb. 12 — Drilling resumed.

Feb. 25 — Trace of oil reported at 822 feet.

Aug. 28 — Pumping started, 50 barrels of oil being taken from well and used as fuel for “Livermore oilfield.” Sand filled the hole for several hundred feet, pumping so tightly it would have to be drilled out.

Oct. 8 — Financial difficulties surmounted. Sand to be drilled.

Oct. 15 — Sixty feet of sand removed and well back on pump. Oil stream from pump small but increasing.


Nov. 5 — Sale of stock authorized to finance purchase of standard rig and drilling of another well. Production from this well not sufficient to justify continuation of pumping but drillers felt that by drilling further back on the formation and deeper they had good production could be obtained. Pumping five barrels a day. Oil used to fire boilers at both Alisal and W. M. & S. and as a demonstration used in cook stove in N. D. Dutcher & Son hardware store.

Dec. 17 — Sufficient funds subscribed to erect a standard rig on a new location but it was decided to postpone action until spring as roads to well became impassable.
About 100 wells were drilled near Livermore in the 120 years after the Hayward earthquake.
It took 100 years to discover commercial quantities of oil.
Details of Livermore oil field
Mt. Diablo arose from tectonic folding a few million years ago.
Eocene sediments were buried to >20,000 ft shortly thereafter.

Steep mountains wear down at about 0.2 mm/yr. That is 6000 ft (2000 m) in 10 million years. Basin sedimentation rates vary greatly, but average values are about 0.1 mm/yr.
Livermore oil probably came from under Dublin and San Ramon

Livermore gravel
Tassajara Formation
Sycamore Formation
Orinda Formation
Contra Costa Group

WNW
San Ramon

Dublin

Ground level

Livermore

ESE

oil field

Greenville Fault

depth below sea level, ft

Cretaceous (Moreno)
Domengine-Tesla Formation
Kreyenhagen-Nortonville shale
Briones-Sobrante sands
Cierbo Formation
Neroly Formation
The miniscule Livermore oil field has become a “major” political issue

Activists opposed the new EPA injection permit saying it would pollute the aquifer and cause earthquakes

The same activists opposed the renewal of the Conditional Use Permit: The County Board of Supervisors agreed

E&B Resources filed suit in Federal Court, and the case is currently under litigation
This book reviews the history oil exploration and production around Livermore, California, from 1868—when oily water started flowing out of a hillside a few miles north-east of Livermore following a major earthquake on the Hayward Fault—to its sunset years. The author has a PhD in physical chemistry from the University of Illinois and has spent much of his career modeling the formation and migration of petroleum.