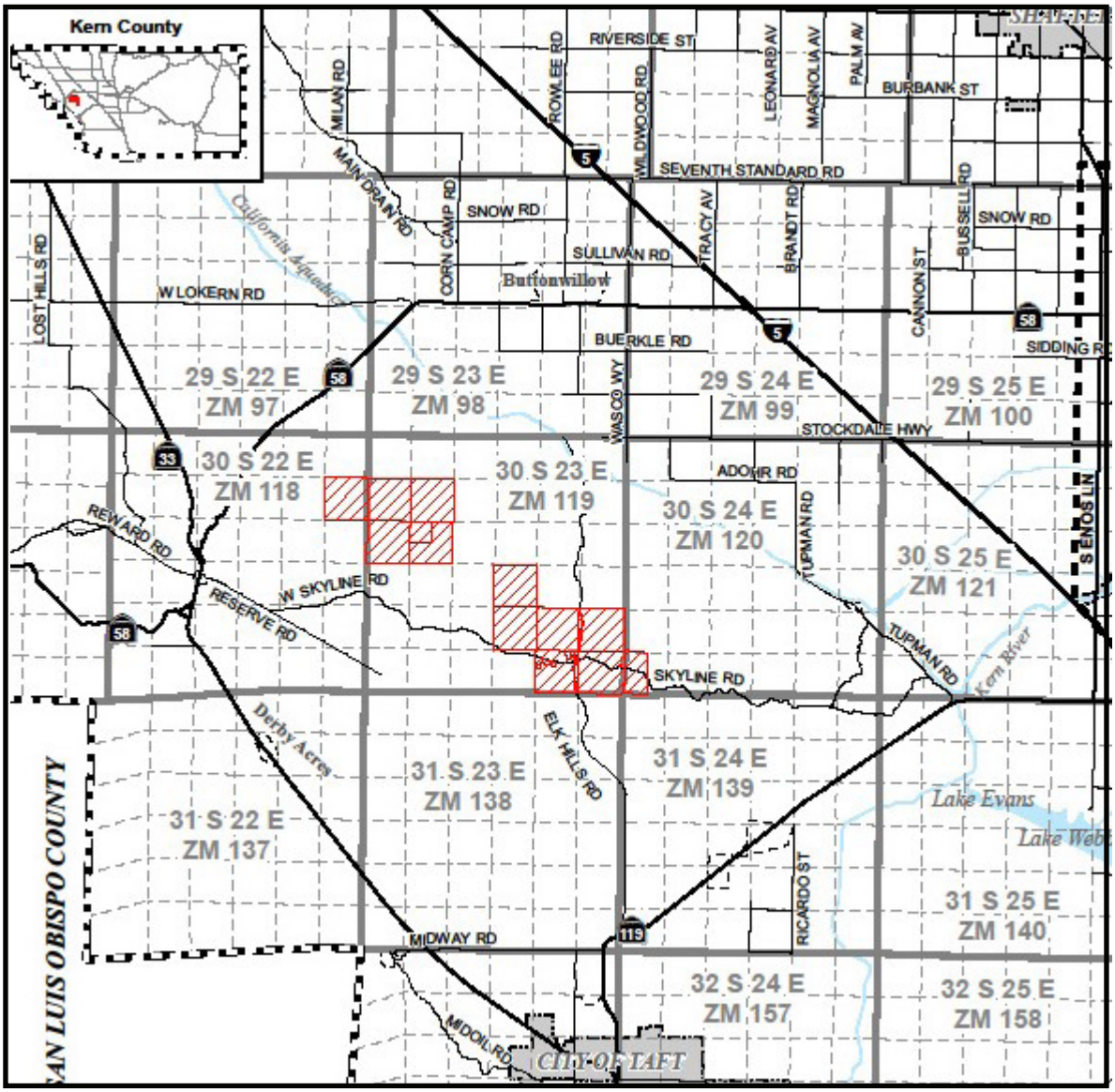
Pacific Petroleum Geology NEWSLETTER

Pacific Section • American Association of Petroleum Geologists March and April 2022

Elk Hills May Be Site of California's First Carbon Capture Project



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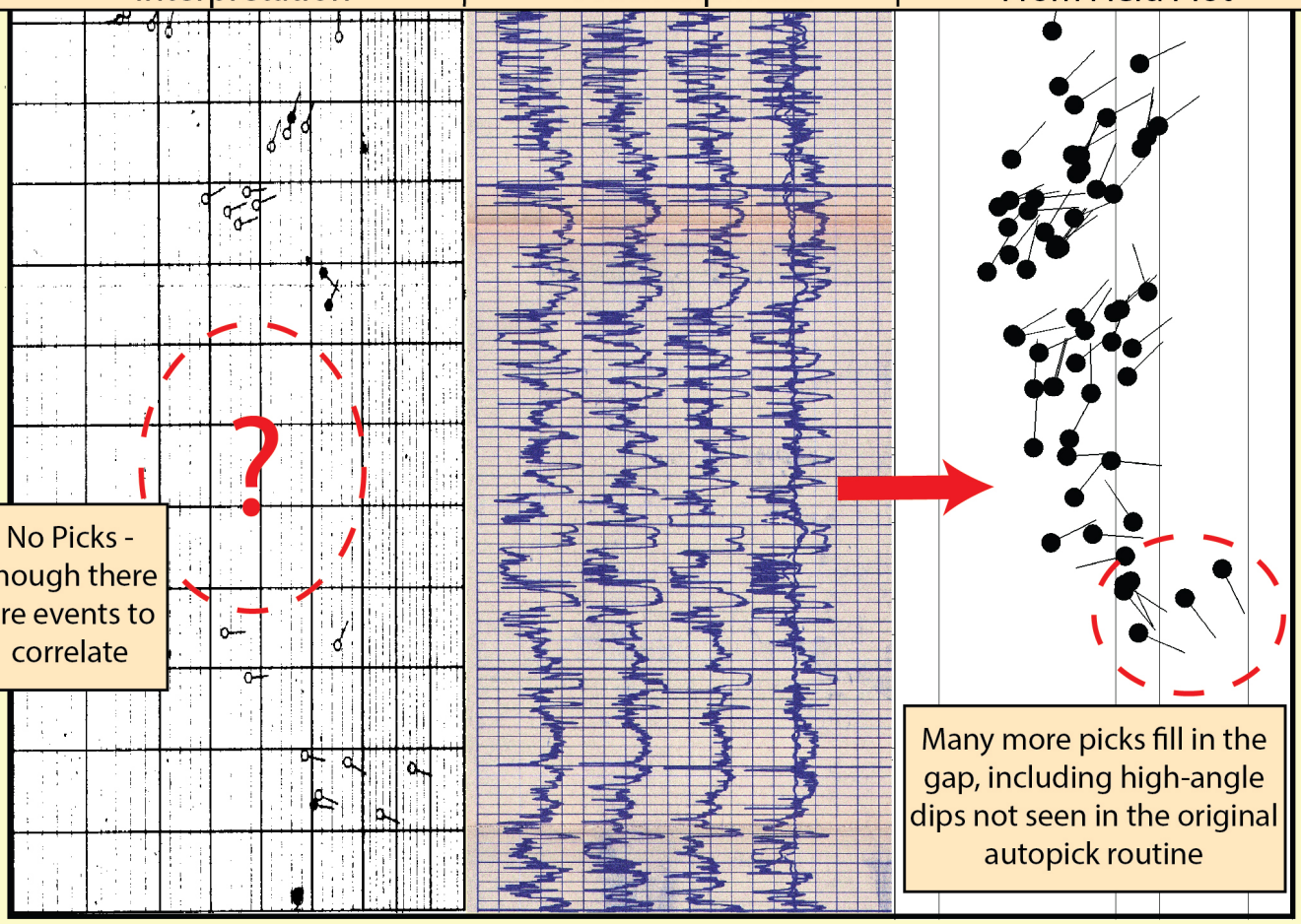

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Cover: Environmental review has initiated for a carbon capture and sequestering project at the Elk Hills Oil Field in Kern County, California. See page 10 to read the Bakersfield Californian article on the project review, and copy and past this link to the Kern County Planning web site to view plan documents: https://psbweb.co.kern.ca.us/planning/pdfs/notices/carbon_terravault1_nop.pdf.

Submit an Article to the Pacific Petroleum Newsletter!

- CONTACT THE EDITOR at editor@PSAAPG.org
- Images (graphics, photos, and scans) must be at least 300 dpi resolution. Text should be at least 600 dpi.
- Scanned photos, illustrations (line art) or logos should preferably be submitted as a .tif, .gif, or .bmp; .jpeg

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Dear PS-AAPG Members,

PS-AAPG is a scientific organization. Specifically, our bylaws state: *"The purpose of PSAAPG shall be to provide for discussion of subjects and problems coming within the scope of the profession and to advance the science of geology and the professional wellbeing of our members. PSAAPG, by such intercourse, will promote the advancement and aims of the American Association of Petroleum Geologists as set forth in its Constitution, Bylaws and Code of Ethics."*

AAPG states in their bylaws: *"The purposes of this Association are to advance the science of geology, especially as it relates to petroleum, natural gas, other subsurface fluids, and mineral resources; to promote the technology of exploring for, finding, and producing these materials in an economically and environmentally sound manner; to foster the spirit of scientific research throughout its membership; to disseminate information relating to the geology and the associated technology of petroleum, natural gas, other subsurface fluids, and mineral resources; to inspire and maintain a high standard of professional conduct on the part of its members; to provide the public with means to recognize adequately trained and professionally responsible geologists; and to advance the professional well being of its members."*

With AAPG's announcement that the SPE-AAPG merger is terminated (see next section), it is a good moment for us to stand back and assess ourselves. We have a moral duty to society to serve and educate our community and broaden our outreach to encompass the future energy needs of those that we serve.

Our professional wellbeing and the wellbeing of our fellow citizens is under fire, and as such, we should broaden our reach to include debate in political dialogue too. As I mentioned in my last column, I am putting together a committee (the Way Forward Committee) to evaluate the future of PS-AAPG. I still have not received any volunteers, so I will be calling on folks personally. If you do have input, please reach out to me (GeologistVaughn@gmail.com). We can keep doing what we are doing, or re-invent who we are to become over the next several decades. The AAPG mentions ***"other subsurface fluids, and mineral resources"*** in their bylaws. Would PS-AAPG and other organizations benefit from our engagement in non-petroleum programs? Certainly, the water industry could benefit from our expertise. Would it strengthen us to branch out, or would it weaken our advancement of petroleum geology? If we expanded our purpose, might we be better equipped to educate policy and public opinion? These are among the questions I pose to you and the Executive Committee. Please let your voice be heard!

I personally feel **very** strongly about being a petroleum geologist, and I do not advocate any diversion from that. But I do see a need for deeper engagement and collaboration with other energy and scientific groups (specifically in the space of energy minerals, water, and geothermal). As multi-disciplinary scientists we need to remember our passions and roots, and continue to grow into other new disciplines. Not "transition" into them as many are advocating, but integrating them into our toolbox. The "transition" movement is yet another tool working against our profession. Advancing and expanding our reach seems critical during a time when pseudo-scientists and podcast-educated alarmists are influencing policy.

By engaging, we can better utilize our proven expertise to help continue providing safe, environmentally responsible, and economical energy. We are especially adept at identifying and mitigating risk, and no group is better equipped to understand and plan for mitigating **real** natural (geological) risks.

SPE-AAPG Merger Update

The SPE-AAPG Merger has been terminated. On March 17, 2022, AAPG President, Gretchen Gillis sent out the following note:

> AAPG and SPE yesterday announced the end of the merger discussions that we began just over 12 months ago. The groups have decided to continue as independent organizations with mutual respect and plans for continued collaboration.
>
> While both AAPG and SPE expected a combined organization to deliver new member benefits and to support integration and learning across the subsurface disciplines, the AAPG Executive Committee ultimately concluded that advancing geoscience and growing opportunities for geoscientists should remain the association's principal focus for now.
>
> Understanding and responding to the needs of our members is why we exist as a professional and scientific association. We also recognize industry expectations and remain committed to innovating and working more closely with SPE and other professional societies to deliver value for our stakeholders. It is a demonstrated fact that geosciences and engineering play a foundational role in providing the oil and gas that fuel the world today. These disciplines will remain essential as the energy sector evolves.
>
> Look for additional information about AAPG's strategies toward the end of this fiscal year. President-Elect Steven Goolsby is leading a strategic and budgetary review to set this course. This review will incorporate the thoughtful work of numerous task forces in the last few years.
>
> Meanwhile, we're concentrating on our upcoming events, including the AAPG Carbon Capture, Utilization, and Storage Conference this month in Houston, endorsed by SEG and SPE. In April, the AAPG International Conference and Exhibition in Cartagena will explore the theme of geoscience and innovation to fuel the energy future. The AAPG/PESGB Energy Transition Forum and the newly launched AAPG/PESGB Business & Exploration Opportunities Show are both scheduled in May in London. Finally, our innovative partnership with SEG on IMAGE, the International Meeting for Applied Geoscience and Energy, will take place in August in Houston. For those staying closer to home, a host of focused scientific/technical workshops is planned around the globe.

I must admit that I am relieved about the decision to terminate the merger plans. With this chapter behind us, we as PS-AAPG can move forward with our own ambitions and purpose.

Pacific Section Rig Count and Observations

The current California Rig Count is seven, down one from last month, despite record breaking oil price increases. Alaska is also down one rig to seven. California is currently producing approximately 350,000 barrels of oil per day. *And remember we consume roughly 1.8MM barrels of oil per day in California, almost 5 times what we produce.*

I need to continue reiterating what I stated in my last columns: a lack of investment in drilling is largely responsible for California's declining production. This lack of investment is driven entirely by anti-oil reporting and false rhetoric by our politicians, agency officials and environmental groups. This kind of deliberate public misdirection was on blatant display this week when House Democrats accused oil companies of "ripping off the American people" and putting profits before production as Americans suffer from ever-increasing gasoline prices during the war in Ukraine (https://www.youtube.com/watch?v=rbHi87cuSBw).

I also urge you to stay informed on the Chevron lawsuit. Chevron is suing Governor Newsom and State Oil and Gas Supervisor Uduak. Their case is strong, and it's about time we fight back against stalled permitting and de facto moratoriums. Our regulators are making dire economic decisions based on poor science created to fulfil a political agenda.

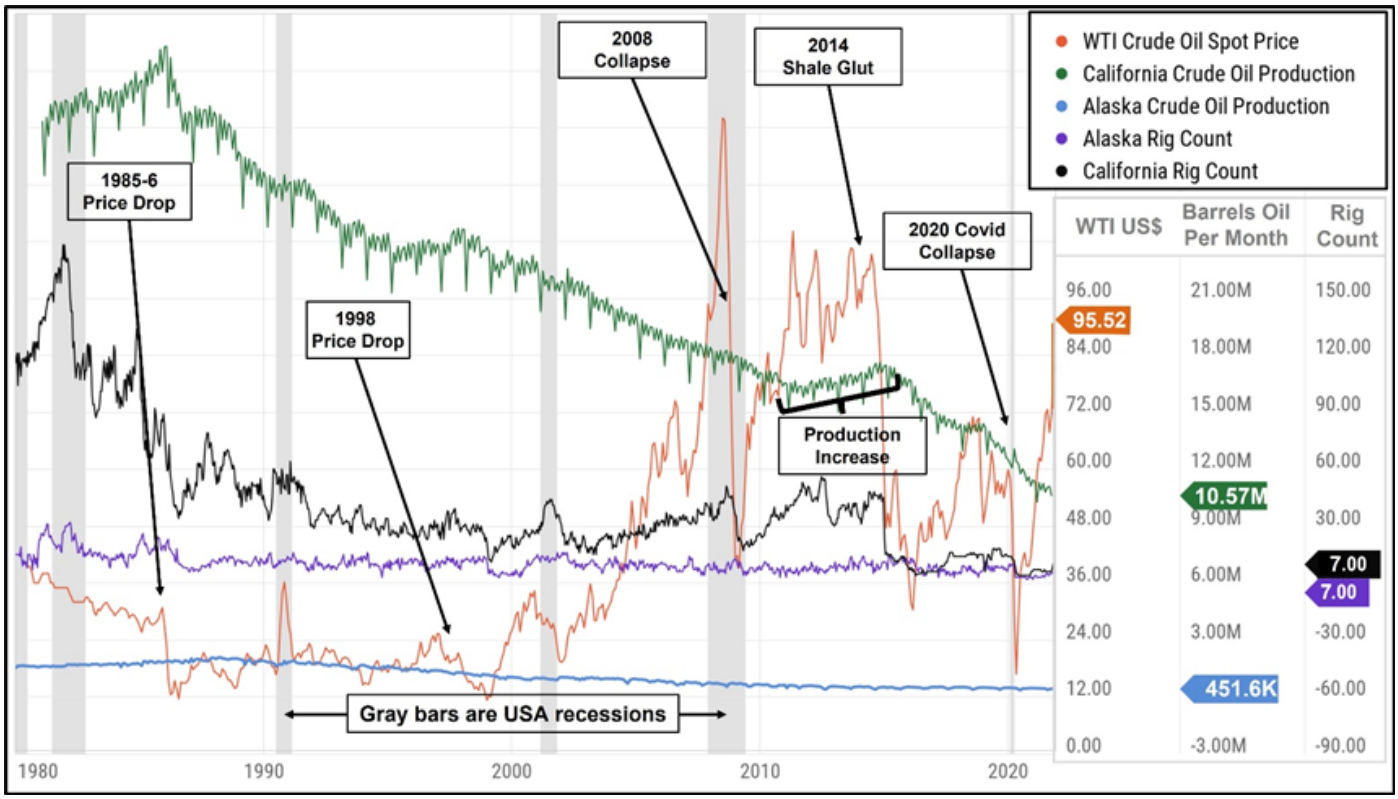


Figure 1: 1980-present rig Count for California and Alaska (other Pacific Section areas have no active rigs). Also included is WTI Crude spot price (US$), California's and Alaska's Crude Production (Barrels of oil monthly). Source data: EIA. Compiled in Y-Charts.

Ultimately, I see us in the business of energy security, and California is an island of energy insecurity. We are always one oil-tanker away from an energy crisis, and we are at the tipping point (and have been for several years) of that crisis. California's energy security is not receiving anywhere near enough attention. Newsom and his legion should be engaging us, not crippling us. Our state depends on it.

My warmest regards,

Vaughn G. Thompson

from the Bakersfield *Californian*, March 18, 2022

Chevron Sues Newsom Over Fracking Ban

by John Cox

Chevron sued Gov. Gavin Newsom and his top oil regulator Thursday in at least the third legal action in six months aimed at overturning the state's de facto ban on fracking.

The filing in Kern County Superior Court says the Newsom administration overstepped its legal authority in September by rejecting the company's application for permits it says the state should have approved based on state law.

Chevron's legal action follows a similar suit Kern County filed against the administration in September, and another brought a month later by the Western States Petroleum Association trade group. Thursday's filing appears to be the first by an oil producer pointing to financial damages from lost production. The petition for writ of mandamus and complaint for declaratory and injunctive relief and damages by Chevron U.S.A. Inc., a local subsidiary of the San Ramon-based major, notes the state doesn't seem to have approved a single fracking permit in at least a year.

State regulators declined to comment Friday on the pending litigation. In October, the governor's press office called WSPA's lawsuit an "attempt by the oil industry to force even more drilling upon our state." It called the suit "a direct threat to our communities and the environment."

Chevron's filing, like the other two suits, argues Newsom has publicly acknowledged that only the state Legislature has authority to impose a fracking ban, as Thursday's petition said lawmakers affirmed when they created the first rules specific to fracking in 2013.

But in the absence of legislative action, Chevron alleged, Newsom, State Oil and Gas Supervisor Uduak-Joe Ntuk and the agency he leads, the California Geologic Energy Management Division, put in place a "de facto moratorium" prohibited by state law. The administration has also launched an administrative effort that would halt the issuance of fracking permits by 2024.

Despite the administration's stated desire to ban fracking in order to fight climate change, the suit said, the moratorium is part of an "unlawful effort to ban WST (well stimulation treatments, usually fracking) activities in California entirely, by executive fiat, outside of the required legislative and administrative processes."

It added CalGEM's application denials do not site a single technical, safety or environmental deficiency "because there is none."

The suit said Ntuk's job, according to state rules, is to "encourage the wise development of oil and gas resources." It said Ntuk is supposed to oversee drilling to let oilfield operators and owners use all locally familiar methods to increase petroleum production in the state.

It goes on to quote the state's 2015 environmental review of fracking, which concluded California's transition away from fossil fuels to renewable energy "cannot occur overnight." It added that a ban on fracking would only lead to greater oil production in "other parts of the nation and world with less stringent environmental laws" leading to more greenhouse gas emissions than allowed without offsets or credits in California.

Fracking blasts water, sand and sometimes toxic chemicals deep underground to open access to petroleum reservoirs. Environmental groups contend it puts groundwater and air quality at risk, but Chevron says it has been done safely for decades in California and that the practice is essential to continued production in mature reservoirs like the Lost Hills Oil Field in western Kern.

In September, Ntuk sent a letter to Bakersfield-based oil producer Aera Energy LLC explaining his reason for denying fracking applications without siting technical problems. Ntuk said he rejected two sets of Aera's fracking applications out of concern for climate change, human health and the economy. The letter also asserted Ntuk, a former Chevron employee, has discretion to deny applications as he sees fit.

But Chevron's lawsuit said the denial of its permits represents an unconstitutional taking of its vested property rights without prior compensation. It says the governor's ban also violates the company's right to procedural and due process and rules regarding administrative actions.

Chevron is represented in the suit by seven lawyers from two separate Los Angeles law firms, Alston & Bird LLP and Gibson, Dunn & Crutcher LLP.

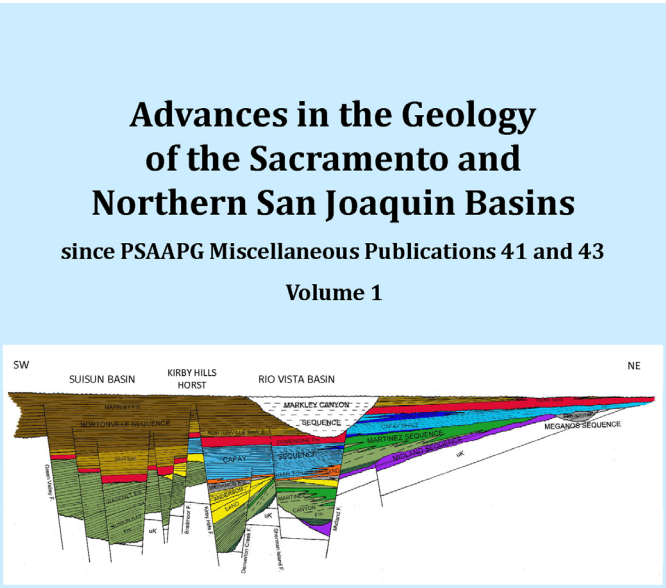
New Pacific Section AAPG Publication

Advances in the Geology of the Sacramento and Northern San Joaquin Basins

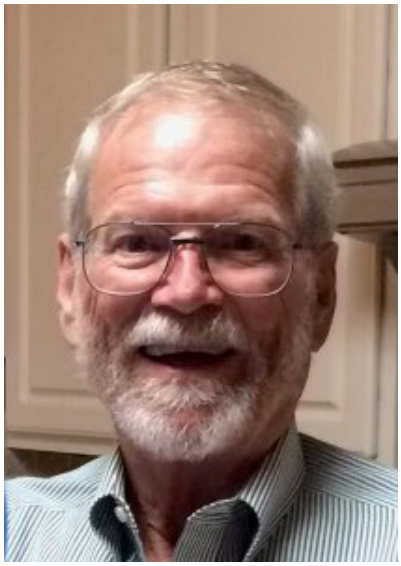
since PSAAPG Miscellaneous Publications 41 and 43

Available by direct download from the PS AAPG web site, or in CD form. In either form, the price is $45.

To purchase, contact the PS AAPG Publisher at Pacific Section AAPG, Publications Chair, P.O. Box 1072, Bakersfield, CA, 93302, or contact Larry Knauer at laknauer@aol.com.



Floyd Presley Wilson, Jr.
December 14, 1939 - February 15, 2022



Floyd Wilson
Photo courtesy of John Howe

Floyd Jr. was born in Alexandria, Louisiana in 1939 to Floyd P. Wilson, Sr. and Ona Estelle Galloway Wilson. Sometime later the family moved to Magnolia, Arkansas where Floyd Jr. attended school and went on to earn his bachelor's degree in Geology from Southern Arkansas University. He was preceded in death by his parents.

Shortly after his graduation he began his seismic career with Seismograph Service Corporation traveling across the southeast United States. He met the love of his life Selwyn Dawn Stallings in Corpus Christi and they wed in 1964. For the next 10 years Floyd was employed by Petty Geophysical Corporation/Petty Ray Corporation. In 1975, Floyd and Selwyn moved to Denver to work with CGG, a French seismic company. He fulfilled his dream of starting his own company in 1979 when he began Wilson Geophysical, Inc (WGI). With WGI he developed a multitude of clients and friends and attended as many golf tournaments and society meetings as possible. In 1992 another dream fulfilled when he moved to Cedar Creek Lake in Texas to begin a new chapter of his life, closer to their children. Floyd retired from Wilson Geophysical in 2019.

Floyd and Selwyn had three children - Bart Wilson who married Paige, Matt Wilson who married Taffney and Beth who married David Trimble. His children blessed them with seven grandkids - Taylor Wilson married to Daniela, Peyton Wilson, Kailee married to George Macatee, Mason Wilson, Haley Wilson, Wilson Trimble, Aubrey Trimble, and one great grandson George Macatee.

Floyd was a legend in the oil and gas industry. A geologist and seismic geophysicist, he was a member of the Society of Exploration Geophysicists for over 58 years, a member of the American Association of Petroleum Geologists and a member of the First United Methodist Church in Malakoff, Texas.

Floyd loved and enjoyed his children, grandchildren and great grandchild, sharing with them his love for fishing, hunting, the outdoors and family. He absolutely valued his friendships and touched many people with his love of life. A great story-teller until the end – he would reminisce about the 'old days' growing up on a farm with cattle, doodle-bugging from the Gulf coast in the south to Wyoming north, hunting and scuba adventures, and traveling with family. He taught his children, and grandchildren, to have a strong work ethic and enjoy life. In other words, work hard and play hard. His true legacy was his integrity, compassion, humor, kindness to all, and never-ending love for family.

There was a Celebration of Life on February 20 at the home of Bart & Paige Wilson and a grave side service on February 21 in Magnolia Arkansas.

The family requested in honor of Floyd, please make donations to American Heart Association and/or the Parkinson Foundation, "In Honor of Floyd Presley Wilson, Jr."

from the Bakersfield *Californian*, March 4, 2022

Kern Launches California's First Carbon Capture Project Review

by John Cox

In preparation for what could be a new avenue in California's fight against climate change, the state's first environmental review of a carbon capture and sequestration project kicked off Friday in Kern County.

The review will focus on a plan by local oil producer California Resources Corp. to gather carbon dioxide from various industrial sources and bury it in depleted oil reservoirs using half a dozen injector wells 26 miles southwest of Bakersfield in the Elk Hills Oil Field.

The project is the furthest along of several such proposals geared toward helping California reach its goal of carbon neutrality by 2045. It would earn state and federal financial incentives if operated as envisioned by Santa Clarita-based CRC.

Carbon TerraVault I, as the carbon capture and sequestration project is known, would bury more than 1 million metric tons of CO2 per year — the equivalent of taking 200,000 passenger vehicles off the road — up to a total of 48 million tons.

"CCS projects can have immediate and long-lasting environmental, economic, and employment benefits to our nearby communities — and we are excited our first CCS project EIR is kicking off in Kern County," CRC said in an emailed statement.

Although the oil industry has increasingly embraced CCS as a way to remove greenhouse gases from the atmosphere, environmental groups remain skeptical, in part because the installations require large amounts of energy and the transport of CO2 over long distances.

The notice of preparation issued Friday by county government said the review will evaluate potential impacts to local air quality, biological and cultural resources, energy usage, seismicity, soil erosion, greenhouse gas emissions, hydrology, water quality, mineral resources, hazardous materials, transportation, noise and public services such as fire and police.

The document released Friday says that, before operation may begin, CRC would need injection well permits from the U.S. Environmental Protection Agency and, from the county, a zone change from limited agriculture to exclusive ag and a conditional use permit.

The project would also require a habitat conservation plan, a waste discharge permit, building and grading permits, plans for fire safety and dust control, an operating permit and a monitoring and reporting program.

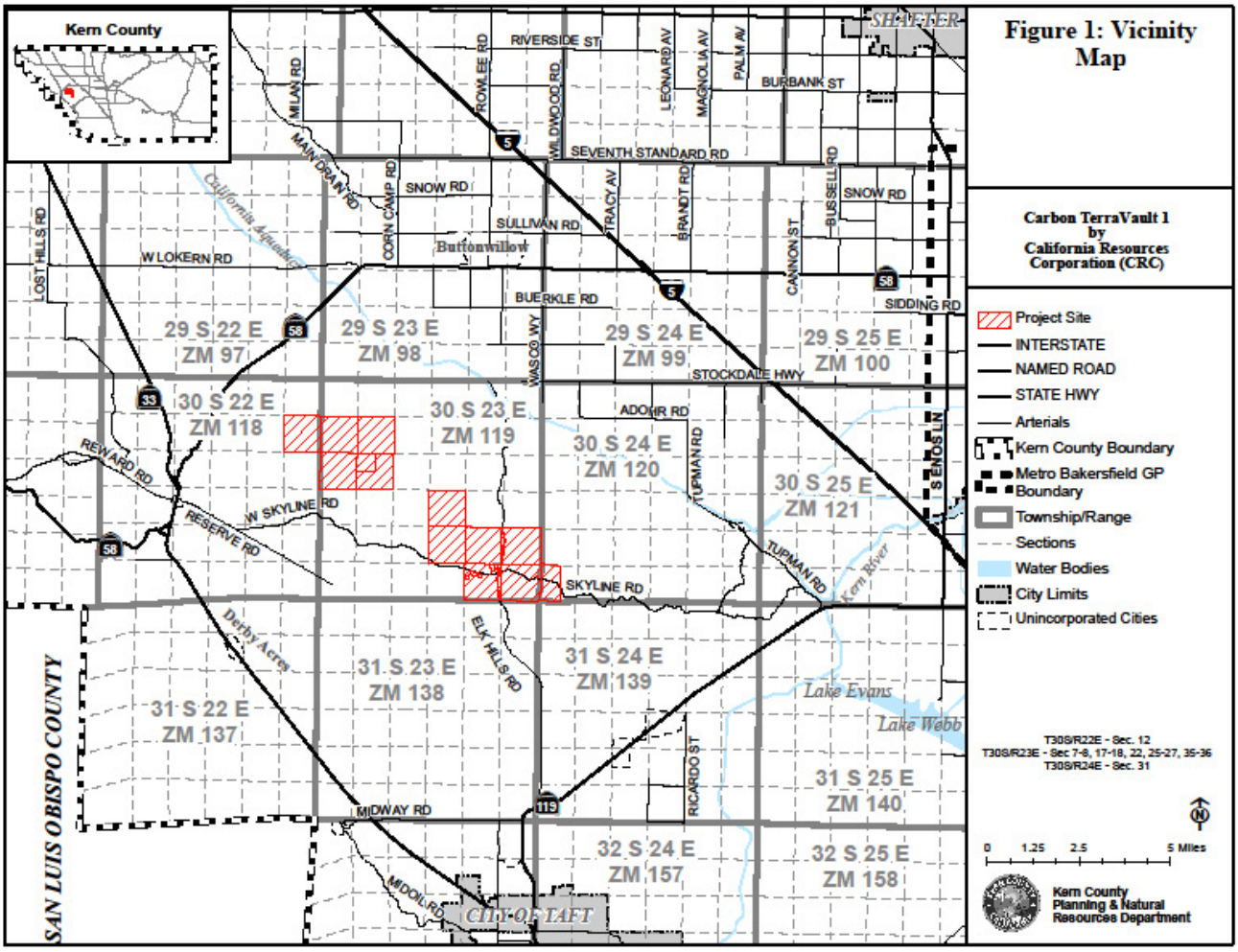
Kern has been identified as an ideal place for CCS because of its wealth of depleted petroleum reservoirs. In addition, the county is equipped with a pipeline network that could be helpful in bringing CO2 to injection wells, though CRC's proposal says trucks and rail could also be used to haul in the gas.

Friday's notice did not specify potential sources of the carbon dioxide CTV I would bury. It said those sources will be identified and analyzed in the draft review.

CRC said it has identified a list of reservoirs in California capable of storing up to 1 billion metric tons of CO2. It added it expects to spend about $85 million this year on its carbon management business. It said those costs account for work to advance pending permit applications and begin early-stage development work.

Lorelei Oviatt, Kern's top planner and director of the county's Planning and Natural Resources Department, confirmed the review that began Friday is the first for a CCS project in California. Public input on the project's draft review is due by 5 p.m. April 4. Anyone may email comments to hooverc@kerncounty.com.

A scoping meeting on the county's environmental review is scheduled for 1:30 p.m. March 18. Information is available online at https://psbweb.co.kern.ca.us/planning/pdfs/notices/carbon_terravault1_nop.pdf.



Project map from the Kern County Planning Department website.

From jpt.spe.org

Update: AAPG and SPE Merger Plans Terminated

At the AAPG Executive Committee meeting on 14 February, several points of concern about the merger plan were expressed and these were subsequently shared with the Steering Committee for assessment. Upon receiving the committee's responses, the AAPG Executive Committee met on 11 March and a vote to continue work on the merger and proceed to a member vote failed.

As we previously announced, a vote by AAPG and SPE members on the proposed merger of our two organizations would only occur if authorized by both the AAPG Executive Committee and the SPE Board of Directors.

At the AAPG Executive Committee meeting on 14 February, several points of concern about the merger plan were expressed and these were subsequently shared with the Steering Committee for assessment. Upon receiving the committee's responses, the AAPG Executive Committee met on 11 March and a vote to continue work on the merger and proceed to a member vote failed.

We continue to believe that the proposed merger of AAPG and SPE would create a stronger organization to serve members effectively in the coming decades. But the time for that action is not now.

The global upstream oil and gas industry is undergoing dramatic change, and each day geoscientists and engineers work together as colleagues to meet the world's energy needs. The professional societies serving these disciplines will continue doing likewise by collaborating on events, sharing knowledge and capabilities, and making a difference together in members' careers.

Visit the AAPG and SPE proposed merger website **here**.

Gretchen Gillis, AAPG 2022 President
Kamel Ben-Naceur, SPE 2022 President

Editor's note: The merger website is no longer active.

Geology of the Tulare Formation at the Lost Hills Oil Field, Kern County, California

Excerpts from Phase 1 UIC Aquifer Exemption Application Package, Tulare Formation Lost Hills Oil Field, Kern County, California

Editor's Note: Aquifer Exemptions are public documents available for viewing and downloading from the CalGEM website (https://www.conservation.ca.gov/calgem/Pages/Aquifer_Exemptions.aspx). Aquifer exemption applications contain a wealth of new geologic and reservoir information much of which has never been presented at technical conferences or in journals. Exerpts presented here focus on the geology of the Tulare Formation. Figures in the text and on figure captions are renumbered to match the discussion. The application was submitted to DOGGR on August 15 2016.

4 OIL FIELD OVERVIEW

Lost Hills Oil Field was discovered in 1910 with the first oil production from the Etchegoin Formation approximately 300 to 530 feet below ground surface (bgs) (Land, 1984). Subsequent discoveries were made in 1913 (upper Miocene Cahn and Reef Ridge) and in 1915 (Pleistocene Tulare). Oil gravities increase with depth, with the Miocene Cahn ranging from 24-32 degrees American Petroleum Institute (API) gravity to the shallow Tulare ranging from 12-15 degrees API gravity. Reef Ridge diatomite production is often commingled with either Etchegoin or Cahn production (DOGGR, 1998). As of March 2016, production from Lost Hills Oil Field totaled 345,944,804 barrels (bbls) of petroleum, and 564,110,576 million cubic feet of gas from these zones (DOGGR, 2016).

4.1 LOCATION

Lost Hills Oil Field is located in the southwestern San Joaquin Valley, approximately 35 miles west of Bakersfield, in Kern County, California. Lost Hills is east of the North Belridge Oil Field and south of the Northwest Lost Hills Field (Figure 1). State Highway 33 is seven miles to the west of the field. State Highway 46 transects the central part of Lost Hills Oil Field from east to west. The California Aqueduct is adjacent to the field boundary on the east and Interstate Highway 5 is four miles northeast of the field (Figure 1).

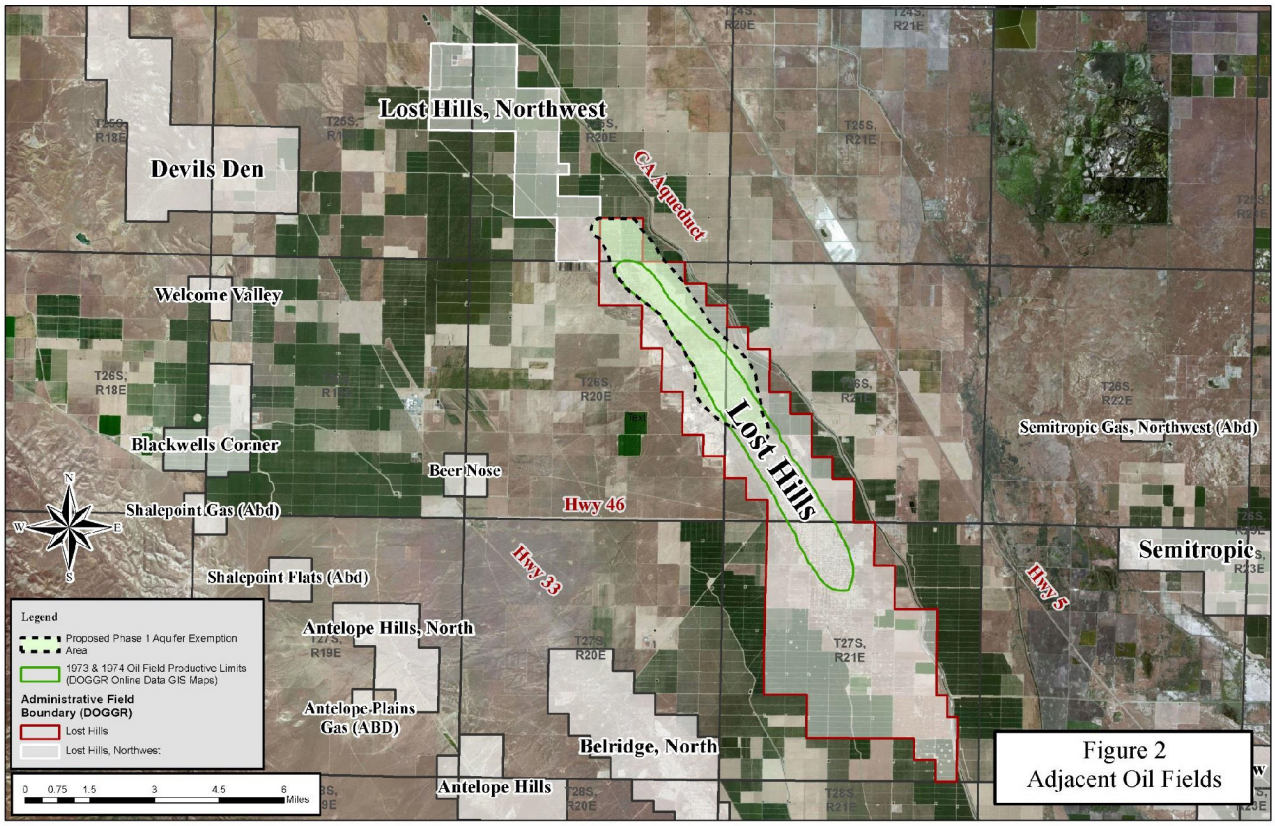


Figure 1. Areal extent of the Lost Hills study area and adjacent oil fields.

Figure 2 shows the current aerial extent of producing Tulare wells and the outlines of the stacked Etchegoin, Reef Ridge, and Cahn producing zones at the Lost Hills Oil Field. Oil production in Lost Hills ranges in depth from 150 feet to over 6000 feet.

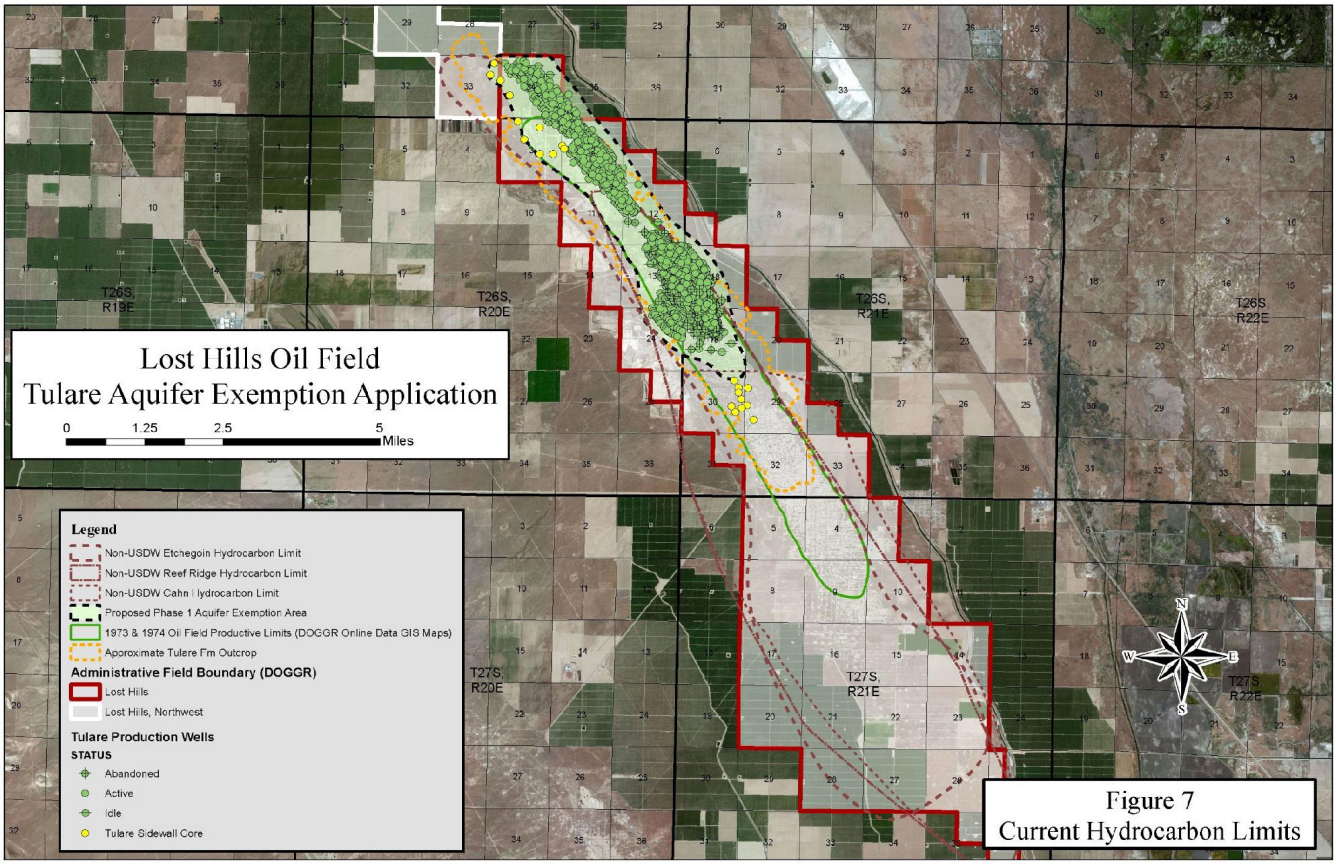


Figure 2. Distribution of all productive intervals.

4.2 OIL FIELD HISTORY

Lost Hills Oil Field is the 19th largest oil field in California. The field was first drilled in 1910 with a discovery in the Etchegoin. Primary production from the Etchegoin and subsequently discovered units (Reef Ridge, Cahn, Tulare) continued until 1946, when waterflood was started in the Cahn Pool (Hardoin, 1964). A series of EOR activities began in the Etchegoin between 1964 and 1995. The Tulare Formation was on primary production until 1962, when a fireflood was attempted and later abandoned, followed by cyclic steam in 1964, steamflood in 1968, and waterflood in 1986. The Tulare is actively being steamflooded, and has cyclic steam injection (DOGGR, 1998).

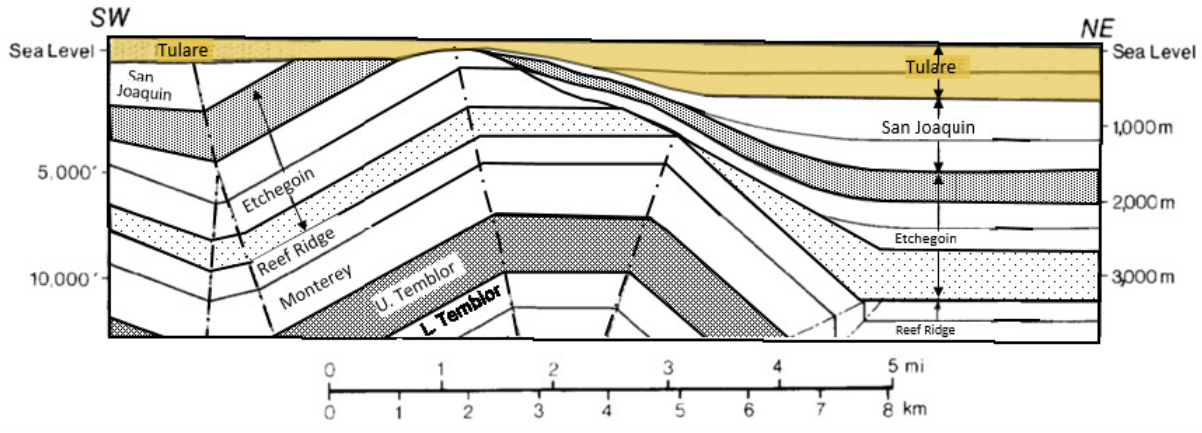
4.3 PHYSIOGRAPHIC SETTING

Lost Hills Oil Field is located in western Kern County east of the Temblor Range. The field lies on the western margin of the San Joaquin Valley on a complex northwest-southeast trending series of geologic structures.

(Sections 4.3.1, 4.3.2, 4.3.3, omitted)

5 OIL FIELD GEOLOGY

Lost Hills Oil Field overlies a zone of deformation located between the San Andreas Fault system to the west and the axis of the San Joaquin Valley to the east. Movement related to slip along the San Andreas Fault system has created synclines and anticlinal features that trend northwest-southeast. A structure cross section by Medwedeff (1989) illustrates the relationship from the Oligocene Temblor to the Pleistocene Tulare Formations (Figure 3). Faults are mapped using seismic and well log data, and are present in the Sub-Monterey to lower Etchegoin Formations in the Phase 1 area (Figure 1). These deeper faults tip out within the Reef Ridge or lower Etchegoin Formations and are not found in the upper Etchegoin and Tulare Formations. Since the Lost Hills anticline was growing during the Pliocene, the silty San Joaquin Formation mudstone was either not deposited on the structure or was eroded during uplift. The San Joaquin Formation is not present or is very thin and indistinguishable from the Etchegoin sandy mudstones in the study area. The San Joaquin Formation is present in the basins off the flanks of the anticline. The cross section also shows the Etchegoin unconformity on the west flank of the oil field, which indicates significant erosion of Pliocene and early Pleistocene strata (Figure 3).



Structural cross section over Lost Hills anticline modified after Medwedeff (1989) showing asymmetric fold with erosion of Etchegoin and San Joaquin Formations with eastward deposition of Tulare Formation thinning onto the structure and thickening to the east.

Figure 3. Structural cross section over Lost Hills anticline from Medwedeff (1989).

The depth and thickness of the Tulare are controlled by the structural uplift and formation of the Lost Hills anticline during the time of deposition. The Tulare Formation thins across the crest of the structure due to non-deposition and erosion, eventually outcropping along the crest of the anticline north of Highway 46 (Figures 4 and 5). The Tulare thickens to the east and down plunge to the south into the non-hydrocarbon bearing and > 10,000mg/L TDS portion of the unit. Typical Tulare thicknesses range from approximately 150 feet where eroded at the crest, to over 1000 feet on the east flank of Lost Hills. The Tulare isochore map (Figure 6) represents the ground surface to the basal unconformity within the outcrop belt, and the top Tulare to

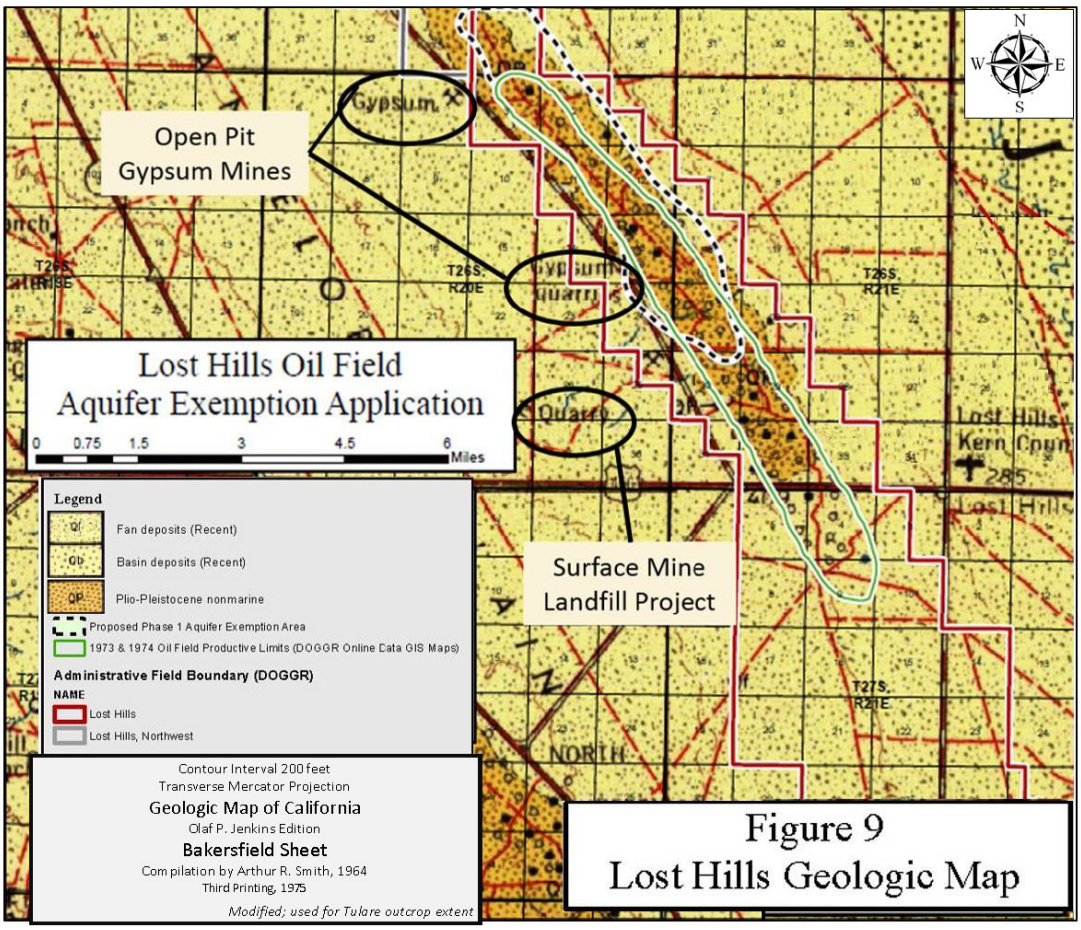


Figure 4. Lost Hills surface geology map and open pit gypsum mines.

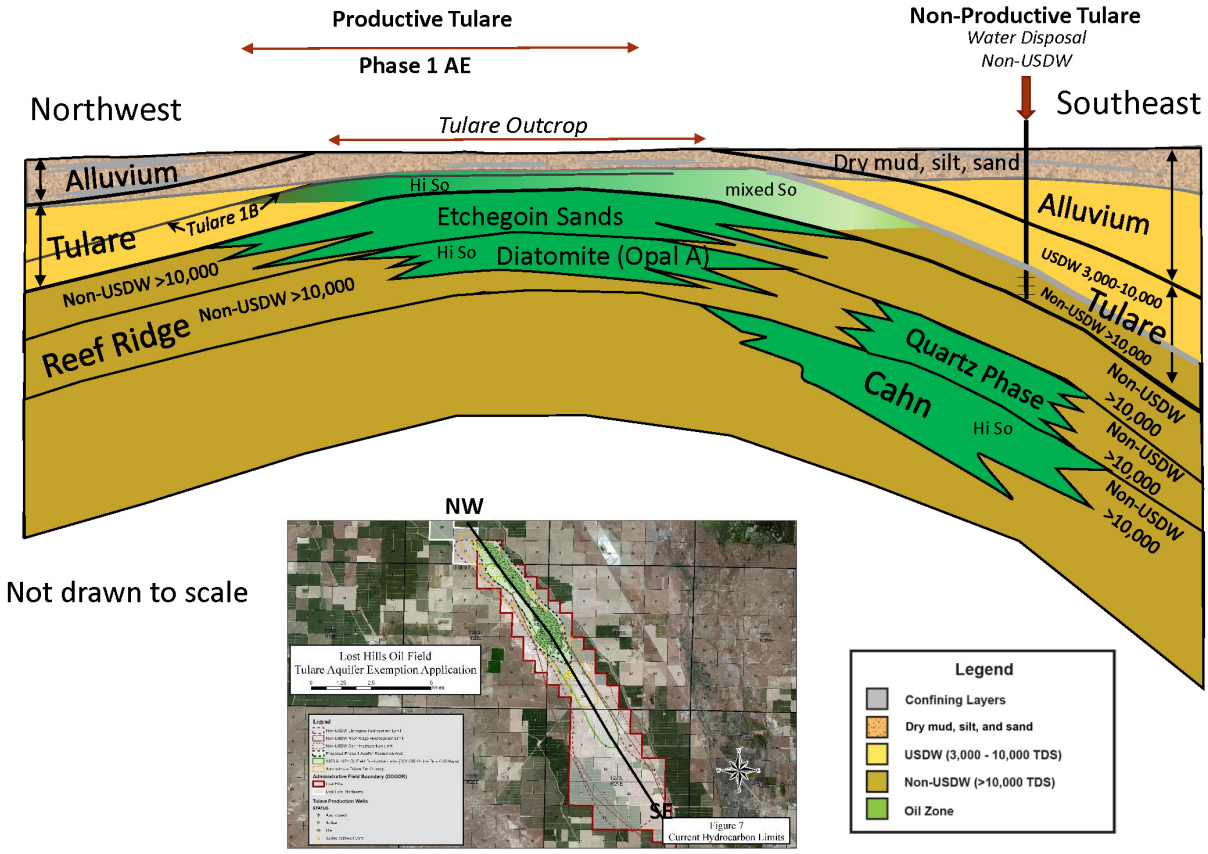


Figure 5. Conceptual strike cross section; Lost Hills Oil Field.

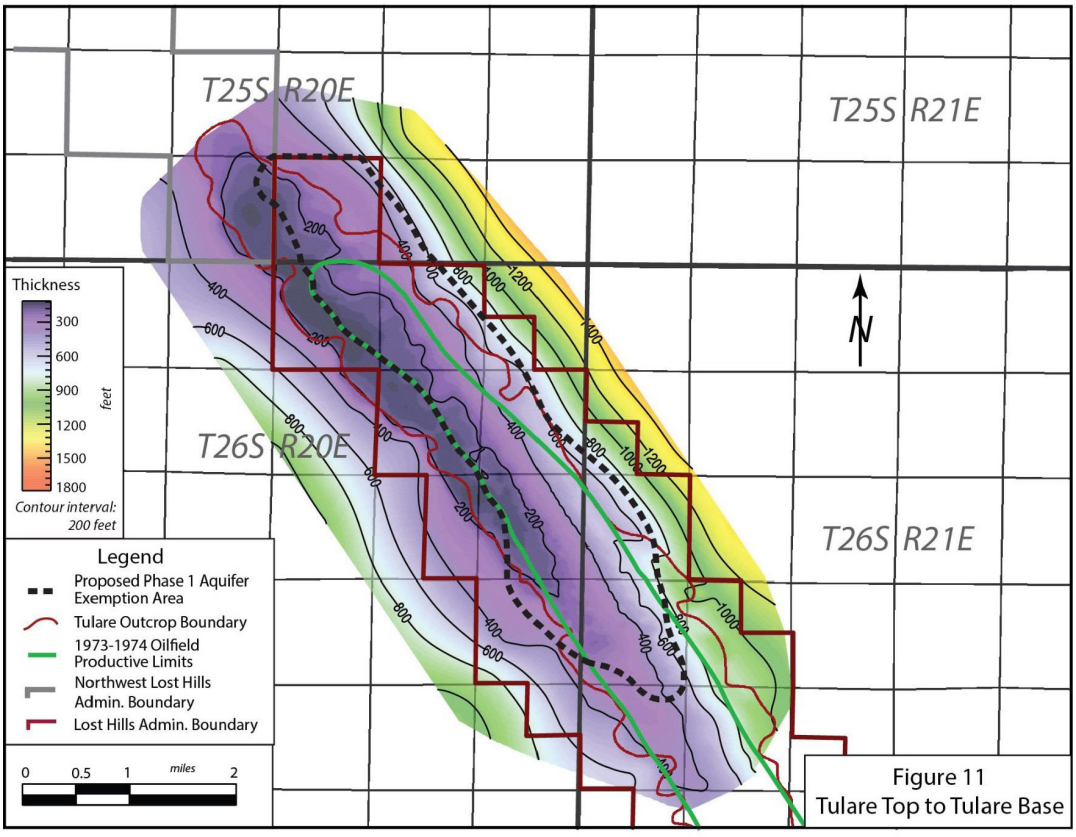


Figure 6. Tulare Isochore map.

the unconformity outside of the outcrop belt. The stratigraphic top Tulare within the belt is not present because the upper Tulare was exposed and eroded. The upper most Tulare correlative unit, identified by operators as the Tulare 1B, is continuous across the Phase 1 boundary area and was mapped as a proxy for the top Tulare.

5.1 GENERAL STRATIGRAPHY

The stratigraphy of the southwestern San Joaquin Valley (Foss and Blaisdell, 1968) comprises marine sedimentary rocks from the Jurassic/Cretaceous through Tertiary Periods and poorly consolidated to unconsolidated non-marine sediments from Late Tertiary and Quaternary Periods (Figure 7).

The oldest marine sediments are exposed in the Temblor range west of Lost Hills. Younger marine formations are exposed to the east, approaching the valley floor. The stratigraphic relationships of these formations are complex, owing to the significant structural deformation present on the west side of the valley.

The units used for Class II injection and discussed in this document are listed below.

Age	Reservoir	Type
Pleistocene	Tulare Formation	non- and USDW Oil bearing and producing
Pliocene	Etchegoin Formation	non-USDW Oil bearing and producing
Miocene	Reef Ridge Formation	non-USDW Oil bearing and producing
Miocene	Cahn	non-USDW Oil bearing and producing

The sedimentary units deposited in the region represent deep to shallow marine to brackish water to terrestrial lacustrine and alluvial depositional environments. The sedimentary units consist of a series of Eocene through Pliocene marine sedimentary rocks overlain by continental sediments of Pliocene/Pleistocene to Present age (Figure 7).

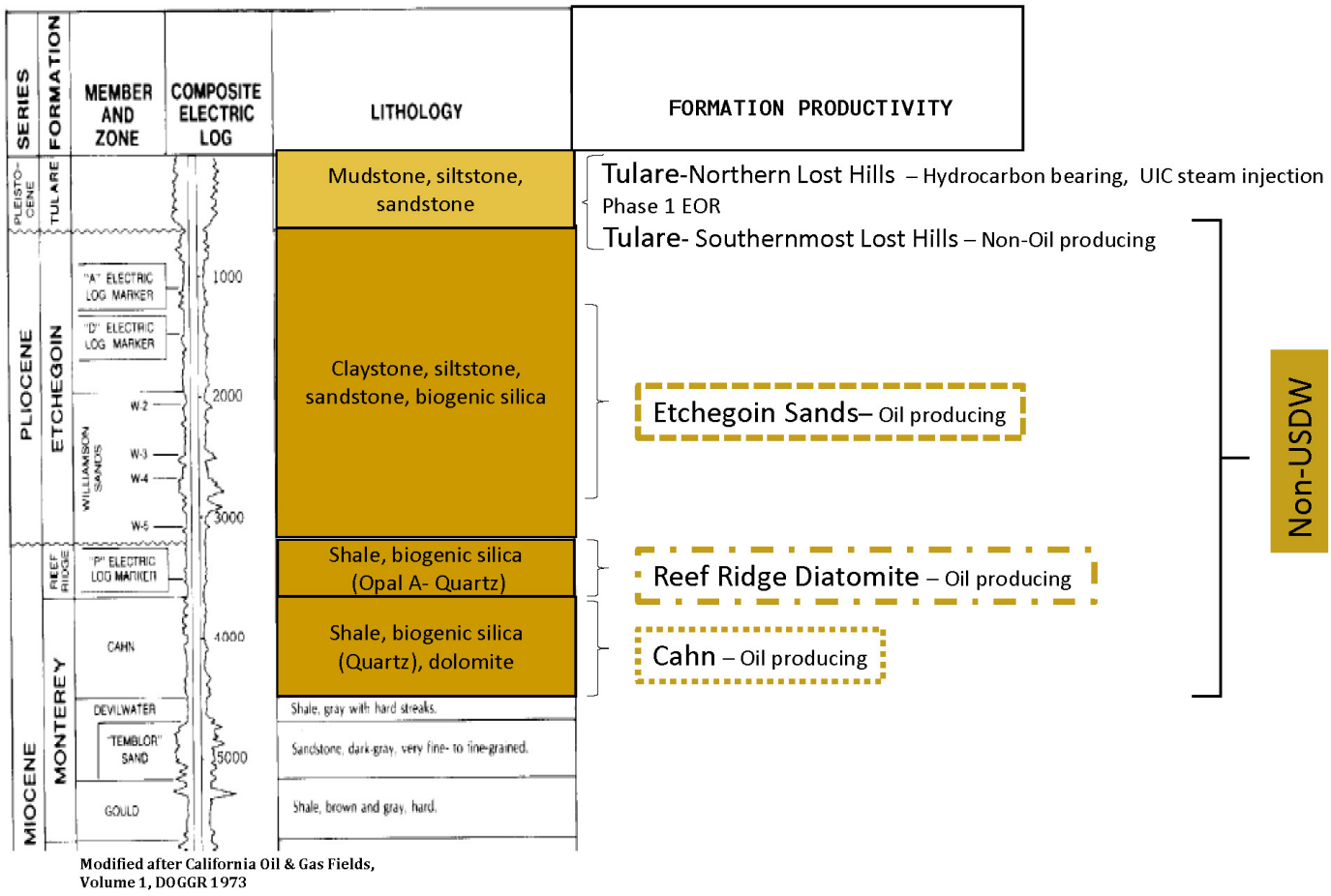


Figure 7. Type log, stratigraphic column, and formation productivity.

The sedimentary formations that underlie the Lost Hills Oil Field from the lowermost unit upward include: Upper Cretaceous Shale, the Eocene Kreyenhagen Shale (containing the Point of Rocks sandstone), the Oligocene Tumey Formation (containing the Oceanic sandstone), the lower Miocene Temblor Formation (containing the Phacoides and Carneros sandstones), the middle to upper (Cahn) Miocene Monterey Formation, the Miocene Reef Ridge Formation, the Lower Pliocene Etchegoin Formation, the Upper Pliocene San Joaquin Formation (occurs in the basin and on the flanks of the Lost Hills anticline), the Pleistocene Tulare Formation, and the Pleistocene to Holocene alluvium. The Miocene strata that make up the Monterey Formation represent deposition in a deep marine environment and unconformably overlie the units of the Temblor Formation. The lowest members of the Monterey are the Devilwater and Gould, composed of mudstones with thin interbeds of calcareous sandstone (DOGGR, 1965). The Cahn is the Lost Hills specific name for the upper member of the Monterey Formation. It comprises the Antelope and McDonald Members, which have been differentiated elsewhere in the basin. The basal McDonald disconformably overlies the Devilwater. The McDonald is primarily silty siliceous mudstone with thin interbeds of calcareous sandstone and is approximately 150 to 300 feet thick (DOGGR, 1965). This member provides a confining layer at the base of the overlying Antelope Shale. The Antelope Shale conformably overlies the McDonald Shale and is comprised of siliceous and sandy mudstone with minor dolomite beds.

The Reef Ridge Formation comprises a diatomaceous mudstone with occasional thin sandstone beds that conformably overlies the Antelope Shale. Locally, the Reef Ridge is referred to as the Belridge Diatomite Member which overlies the Lower Brown Shale Member. The Belridge Diatomite is comprised largely of opal-A Diatomite with the basal portion transitioning into opal-CT and quartz with depth along the plunge of the anticline to the south. The Lower Brown Shale Member consists of opal-CT and quartz phases.

The Etchegoin Formation unconformably overlies the Reef Ridge Formation and consists of a heterogeneous mix of marine diatomaceous mudstones, sandstones, and siltstones. Off the structure, the Etchegoin is overlain by the San Joaquin Formation, a transgressive marine to brackish water mudstone (non-reservoir). The San Joaquin either was eroded from the top of the growing Lost Hills anticline, or was not deposited due to positive structural relief.

The Pleistocene Tulare Formation overlies the Pliocene Etchegoin Formation with an angular unconformity, and is the shallowest hydrocarbon bearing unit in Lost Hills. The Tulare Formation is a non-marine, interbedded sequence of poorly consolidated conglomerate, sandstone, siltstone, and mudstone (Foss and Blaisdell, 1968). Operators mapped an angular unconformity at the base of the Tulare on the west flank of the field using 3-D seismic reflection data and depth correlated with logs. A basal sand overlies this unconformity and is interpreted as the first alluvial continental deposition following regression of the Etchegoin marine seas on top of the exposed Lost Hills structure.

The Tulare is overlain by Holocene alluvium sourced from the Temblor Range and comprising sequences of interbedded, unconsolidated gravels, sands, silts, and muds deposited in an alluvial setting. The similar depositional settings make it difficult to differentiate the two units but the presence of incised channels and gypsum cemented mudstones north of Section 19 (T26S, R21E) support the outcrop mapping of the Tulare (Smith, 1964). South of Section 19 (T26S, R21E) but north of Highway 46, the operator has interpreted a very thin layer of the Holocene alluvium at the surface.

Geophysical log data and field observations indicate that the alluvium is absent of groundwater. The unsaturated alluvium and upper portion of the Tulare Formation is typically referred to as “air sands” due to air filled pore space, which is observed on geophysical logs (Figure 8).

5.2 REGIONAL STRUCTURE

The regional geology in the southwestern San Joaquin Valley is characterized by a long history of structural deformation associated with tectonic movement along the continental borderland, including the prominent and still active San Andreas Fault. Uplift of the Sierra Nevada east of the valley, later uplift of the Temblor Range on the west side, and formation of the deep structural trough beneath the valley floor, have resulted in the accumulation of more than 20,000 feet of marine and terrestrial sediments of Cretaceous to Holocene age throughout the basin (Maher et al., 1975).

The San Joaquin Basin is approximately 250 miles long and 55 to 85 miles wide. The basin is bounded by the Sierra Nevada Mountains to the east, the San Emigdio and Tehachapi Ranges to the south, the Stockton Arch to the north, and the Coastal Ranges to the west. The San Andreas Fault trends northwest to southeast through the Coast Ranges. The San Joaquin Basin was a fore arc basin, with a subduction system located on the southwest margin. Subduction was active from at least the early Cretaceous until the late Oligocene to early Miocene, when a strike-slip tectonic system developed on the southwest margin of the basin. The strike-slip system caused uplift in the southwest portion of the basin, eventually closing the basin from the ocean

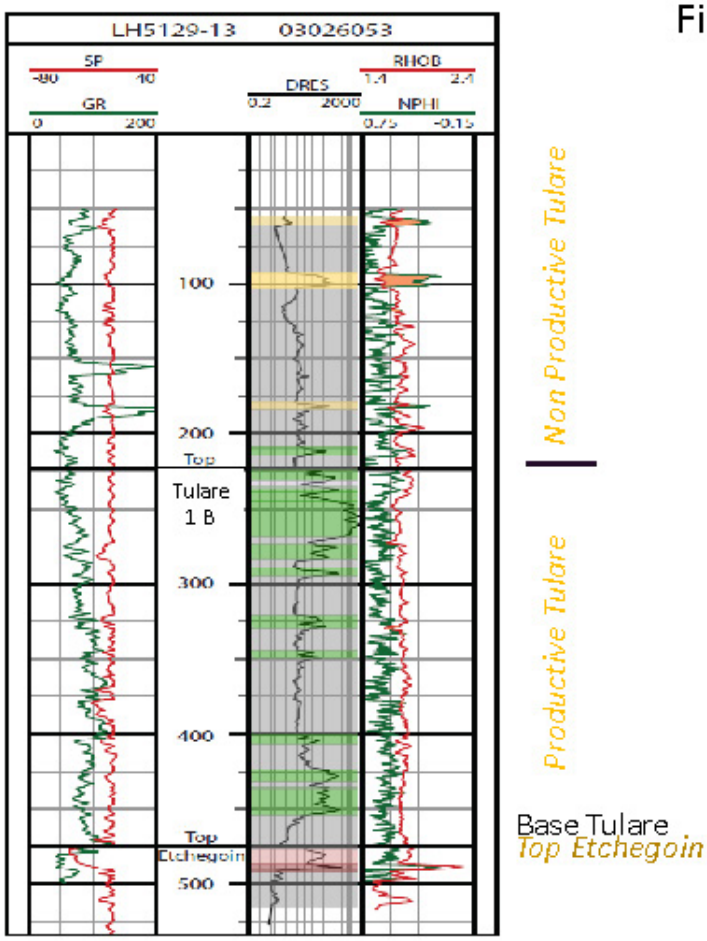


Figure 13: Tulare type log

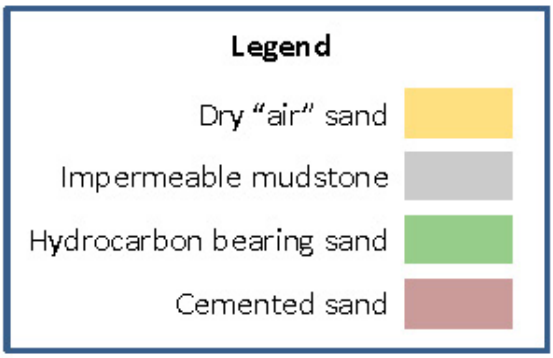


Figure 8. Tulare type log.

and filling it with sediment. Low angle thrusting and en echelon folding from transpressional motion of the San Andreas Fault began on the southwest side of the basin as early as the late Eocene.

According to Magoon et al. (2003), two major depositional centers in the San Joaquin basin served as hydrocarbon cooking pots: the Tejon and Buttonwillow depocenters, and the oil in the Lost Hills Field migrated through fractures from Kreyenhagen and Monterey source rocks in the Buttonwillow depocenter into the overlying Miocene. The Buttonwillow depocenter east of Lost Hills was buried sufficiently for deep reservoirs to be charged with oil by the late Pliocene to early Pleistocene. The Tulare Formation was charged from Monterey Formation source rocks starting in the mid-Pleistocene. The uppermost source rock, the Antelope Shale, is in the early phase of oil-generation and will continue into the future (Scheirer, ed., 2007). Estimated migration pathways are to the northwest along the crest of Lost Hills, to the southwest from the basin, and to the northeast from the local basin between Lost Hills and North Belridge.

6 USDW TULARE AQUIFER CHARACTERIZATION

Tulare Formation oil production commenced in 1915 (DOGGR, 1998). The Tulare Formation is stratigraphically the uppermost hydrocarbon bearing zone and is productive in northern Lost Hills Oil Field. While the Tulare is encountered at variable depths from 0 to over 1,000 feet bgs, the top of the hydrocarbon column occurs from 50 feet bgs in the north to over 500 feet bgs in the south. Steam drive EOR is the primary mechanism for Tulare heavy oil production. The shallowest injection depth is 150 feet bgs. Table 1 summarizes the Tulare reservoir properties.

The Tulare Aquifer Exemption boundary was determined by hydrocarbon production (Figure 9). On the west side of the field, oil-bearing Tulare is contained by delta plain mudstones, sandstone pinchouts, and the hydrodynamic system in the syncline. On the eastern flank of the field, hydraulic containment is due to sandstone pinch-outs into lacustrine mudstone, and mass balance of fluid production versus injection.

Discovery	1915
Geologic Age	Pleistocene
Depositional Environment	Alluvial Fan / Fluvial / Lacustrine
Average Depth (ft-tvdss)	200
Net Thickness (ft)	100-450
Average Porosity (%)	35 - 45
Residual S_{oi} (%)	50 - 70
Residual S_{wi} (%)	30 - 50
Aveage Permeability to air (md)	1,500 - 2,000
Oil Gravity (API)	12 - 18
Viscosity (cp @ °F)	1,200 @ 82
Initial Reservoir Pressure (psi)	70
Initial Reservoir Temperature (°F)	75 - 82
Average TDS (ppm)	15,500

DOGGR, 1995

Table 1. Tulare reservoir properties

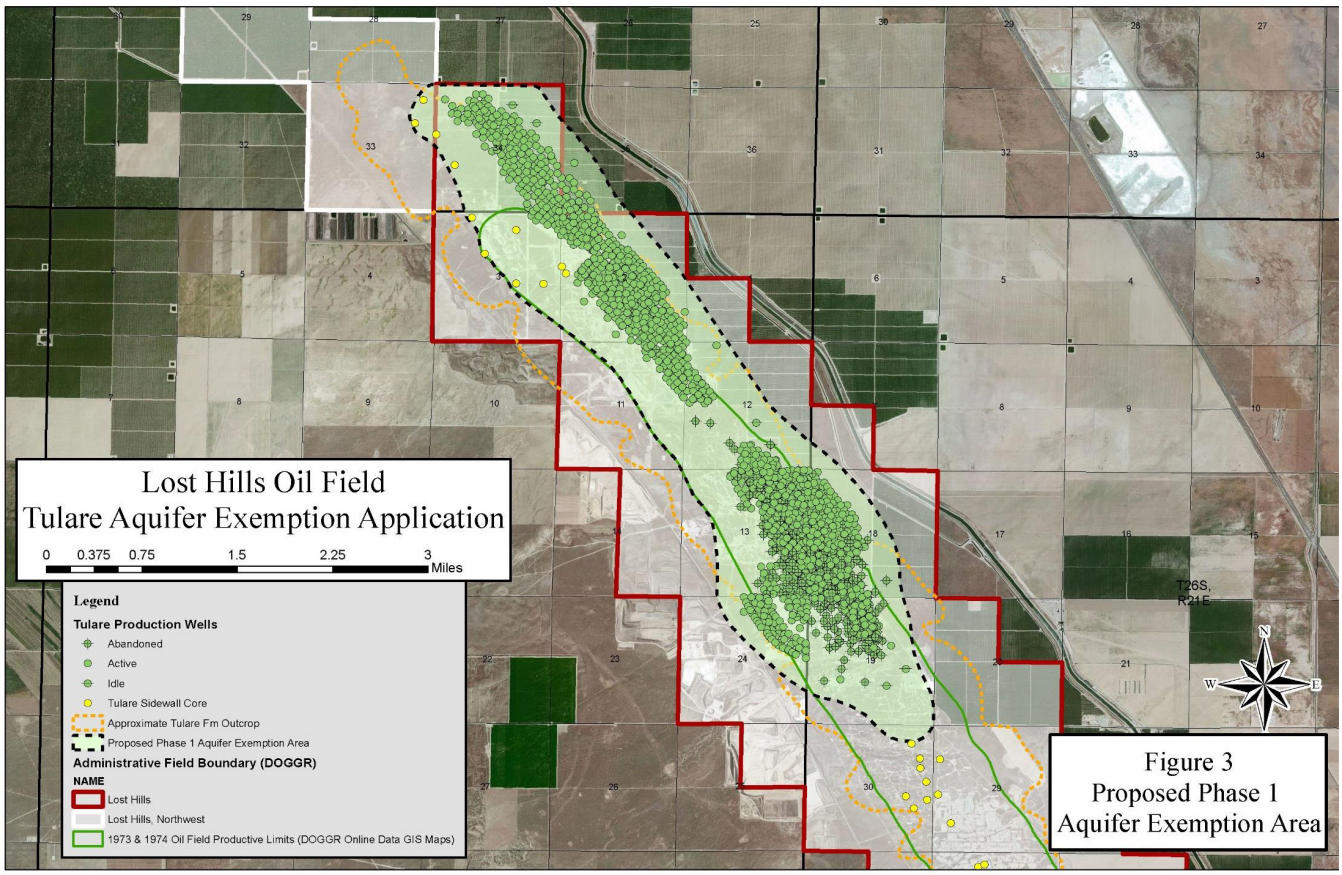


Figure 9. Proposed Phase 1 aquifer exemption area

6.1 TULARE DEPOSITION, STRATIGRAPHY AND LITHOLOGY

The Tulare Formation and overlying Holocene alluvium consist of coarse-grained alluvial fan, fluvial channel, and lacustrine coastal plain facies shed eastward from the uplifting Temblor Range (Foss and Blaisdell, 1968). It sits unconformably atop the Lower Pliocene Etchegoin Formation at the crest of the anticline and the Upper Pliocene San Joaquin Formation off the flanks. West of Lost Hills, the Tulare consists of poorly sorted alluvial sandy mudstones and fluvial sandstones intercalated with coastal plain fine-grained sandstones, mudstones, and gypsum cemented mudstones of delta marsh origin.

Water evaporation during dropping lake level deposited gypsum in broadly distributed beds (Figure 10). These cemented sands have been open-pit mined for the gypsum for many years (Figure 4). In 2010, Holloway Gypsum requested a permit to convert some of the mines into industrial (solid waste) disposal sites. The application describes 25 to 60 consecutive feet of calcite-flocculated or cemented, very low permeability clays and clayey silts (10-7 to 10-10 cm/sec). In addition, well or core drilling information from within the area indicates a potential thickness of this same soil profile of greater than 350 feet bgs (Landfill Permit 15-AA-0308). Because the geological characteristics of the formation meet sitting criteria for Class III landfill contained in 27CCR20260(a) and (b)(1); and as construction of additional waste containment features was not required per 27CCR20260(b)(2) and SWRCB Resolution No. 93-62, it is the operators belief that the cemented Tulare on the west flank of the field will be an effective barrier to down flank flow from EOR operations (http://www.co.kern.ca.us/planning/pdfs/eirs/holloway/holloway_landfill_eir_addendum.pdf).

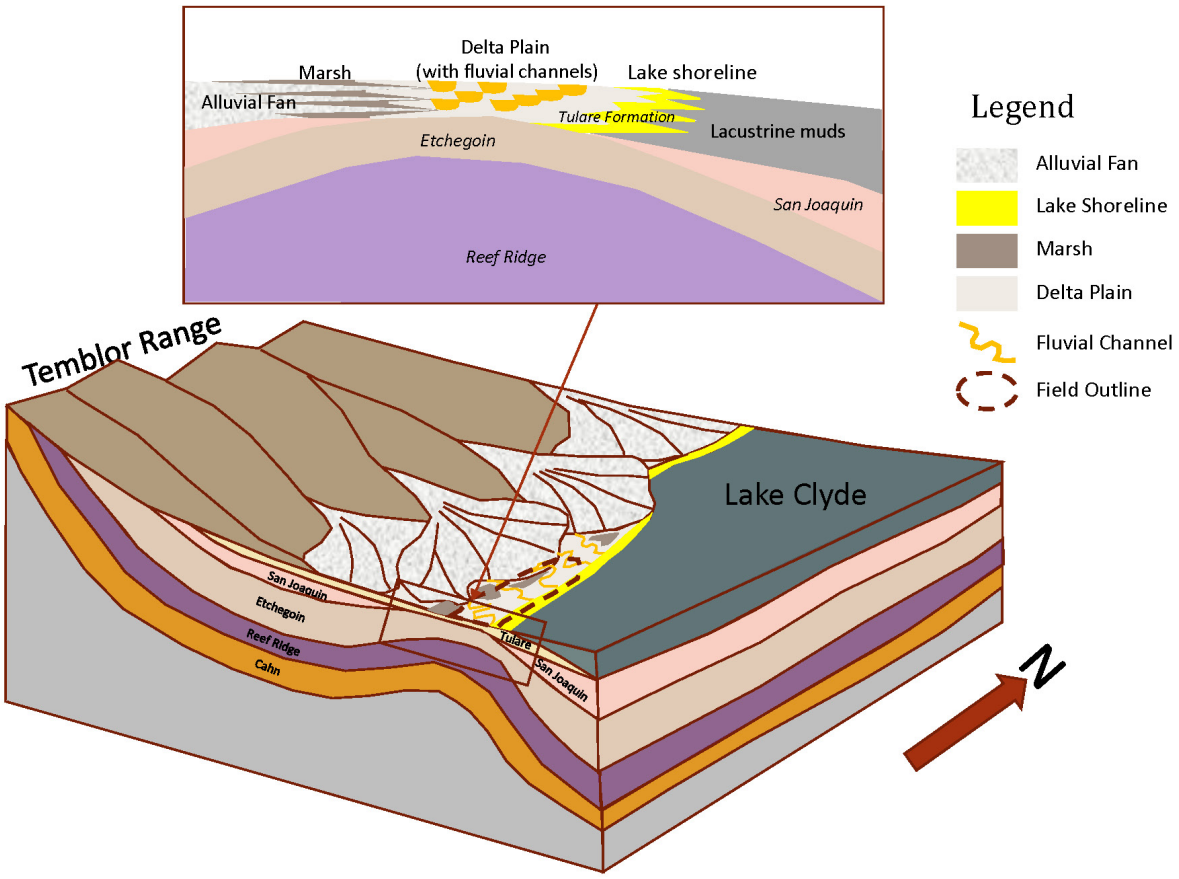


Figure 10. Tulare depositional block diagram.

At the crest of the anticline, the alluvial and fluvial facies become interbedded with fine-grained facies associated with coastal plain (marshland and delta) and lacustrine shoreline deposits from the pre-historic Lake Clyde and historic Tulare Lake (Harden, 2004). On the east flank of the field, fine-grained sandstones pinch out eastward into lacustrine mudstones. The Corcoran Clay that distinguishes much of the Tulare elsewhere in the San Joaquin Basin does not occur at Lost Hills. The Tulare Formation thickens from north to south along the axis of the Lost Hills Anticline due to depositional thickening and the erosion of the upper portion of the Tulare to the north (Plate 1), and thickens westward and eastward, off the anticline axis (Plate 2).

Local topographic features like the Lost Hills Anticline enabled the deposition of shoreline deposits at the margin of the Pleistocene Lake Clyde. At Lost Hills, the Tulare Formation was deposited as a transgressive-regressive lacustrine sequence. The initial deposit resulted from a transgressive shoreline facies deposited across the eroded topographic feature that marked the surface expression of the Lost Hills Anticline. The maximum transgressive phase resulted in the northeastward thickening claystone and mudstone wedge. Interbedded siltstones and mudstones thinned across the anticline and thickened toward the deeper portion of the lake basin. The gross thickness of sand packages is greatest downdip, but the sands thin eastward into thickening mudstone interbeds. Fine-grained material

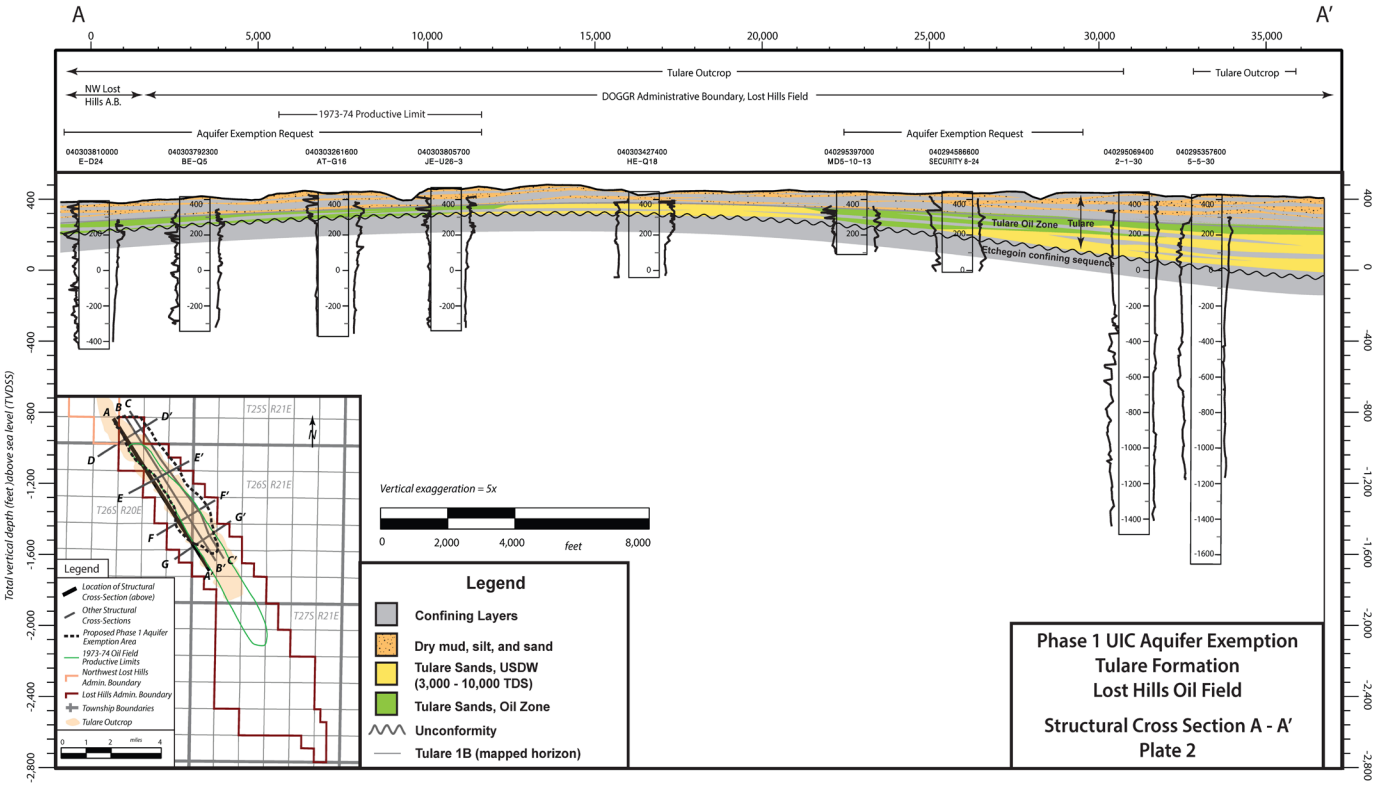


Plate 1. Structural Cross Section A-A'.

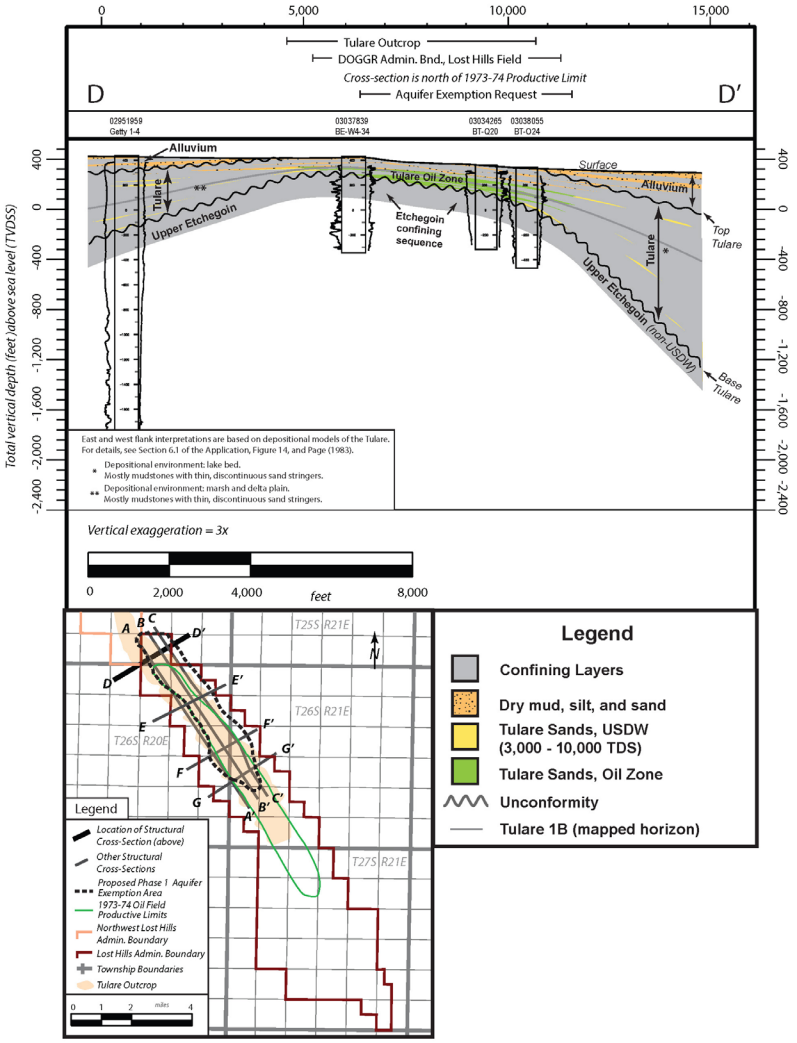


Plate 2. Structural Cross Section D-D'.

was deposited into the shallow lake. The regressive phase of deposition resulted in broadly distributed alluvial mudstones and occasional fluvial and deltaic plain sandstones.

The Tulare Formation consists of numerous variably stacked low permeability mudstones intercalated within 5 – 25 foot thick sandstones. The sandstone is poorly consolidated, very fine to coarse-grained, with moderate amounts of clay and silt-sized grains. Average sandstone porosity in the productive reservoir is approximately 35% with permeability ranging from 200 – 5,000 milliDarcies (mD).

Intercalated, discontinuous, heterogeneous silts and mudstones commonly occur within the Tulare. Permeability of the silts and mudstones is commonly below 10 mD and can be as low as 1 mD (Figure 11). The distribution of these interbedded layers provide competent barriers and baffles to fluid distribution and effective fluid migration in the reservoir.

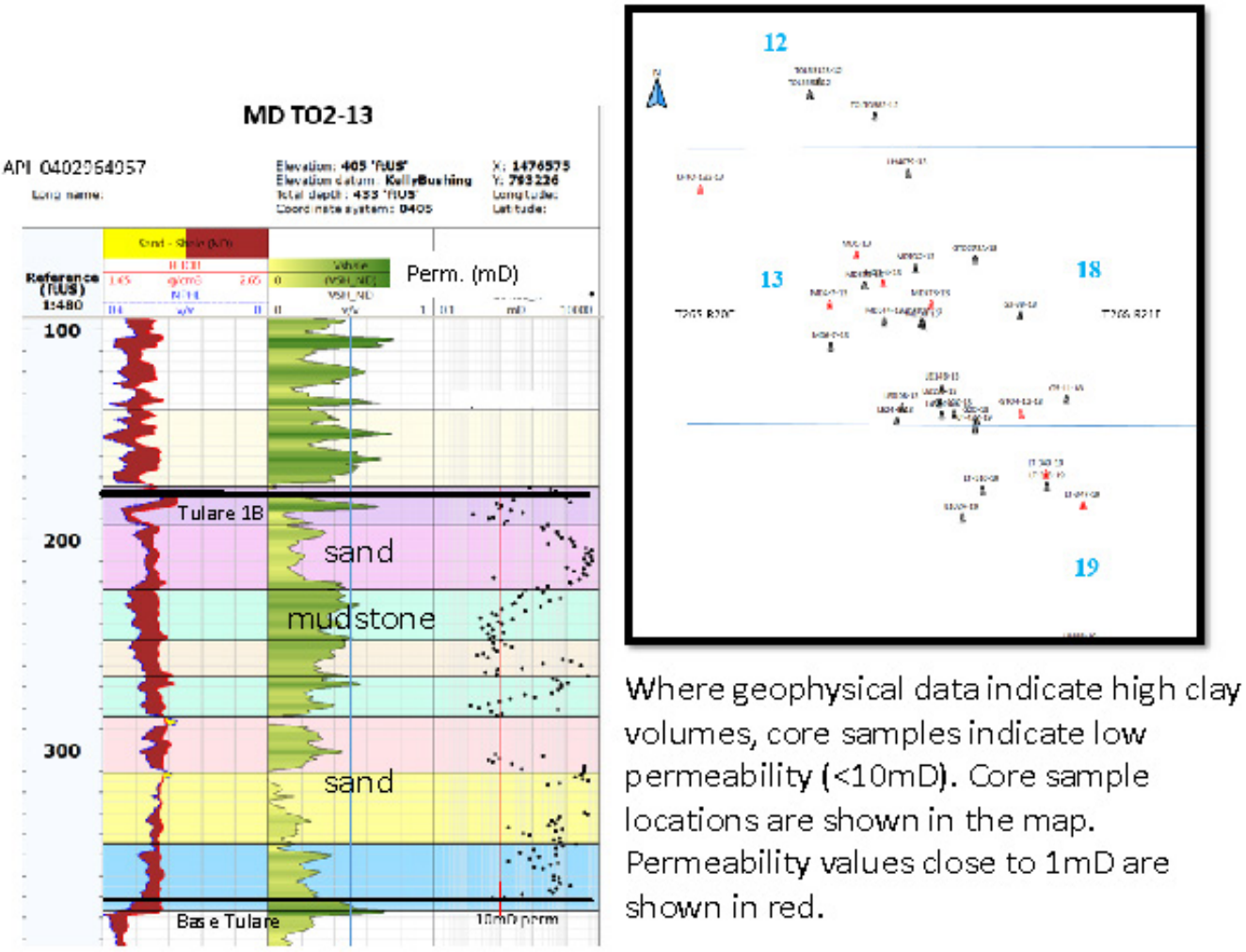


Figure 11. Tulare permeability data

6.1.1 Tulare Type Log

The lithologies of the Tulare Formation are identifiable on geophysical logs (Figure 8). The geophysical logs are the basic "open-hole logging suite" typically used at the Lost Hills Oil Field, comprising gamma ray, spontaneous potential, shallow resistivity, deep resistivity, neutron porosity, and bulk density logs. These logs together enable the identification of Tulare Formation lithologies and the presence of fluids. In addition, correlating the high density of well logs demonstrates there are no mappable faults within the Tulare Formation in the Phase 1 area. The Tulare Formation oil sand is identified by blocky high resistivity, and neutron-density curves overlying and tracking together (Figure 8).

6.1.2 Tulare Air Sands

The Holocene alluvium and unsaturated Tulare Formation (air sands) are identified primarily by neutron porosity and resistivity curves. Neutron porosity and bulk density plotted on standard scales exhibit "crossover" (Figure 8). In the air sands, a low neutron porosity value is due to air filling the pore space. The bulk density log measures the total density, a combination of rock and fluid densities. The density of air is much less than the density of water or oil, which results in a low measurement.

Development wells have surface casing set 50 to up to 400 feet bgs within the EOR area, and logging tools do not penetrate the casing to identify air sands. Operators have drilled shallow borings (50 –100 feet deep) validating the existence of air filled pore space in these strata (Amec, 2014; Holguin, Fahan & Associates, Inc., 1995).

The Tulare air sands are unsaturated from the surface to the first encountered saturated zone, which is oil-bearing in the Phase 1 area.

6.1.3 Oil-bearing Interval
The hydrocarbon saturated interval consists of interbedded layers of sand, silty sand, silt and mudstones deposited in alluvial, fluvial to lacustrine depositional settings. The hydrocarbon bearing EOR reservoir sands are laterally discontinuous. Hydrocarbons in the Tulare Formation range from trace amounts in the south to 70% in the north, where it is undergoing EOR development.

(Section 6.2 omitted)

6.3 HYDROCARBON PRODUCTION
The Tulare Formation is stratigraphically the uppermost hydrocarbon bearing zone and is hydrocarbon bearing throughout northern and central Lost Hills Oil Field. Oil sands are encountered at variable depths from <50 to over 1,000 feet bgs. The Tulare reservoir in Lost Hills contains heavy oil with oil gravity ranging from 12-18 degrees API, averaging 13 degrees API. Over 760 wells currently produce from the Tulare Formation, and have produced over 123 million bbls cumulative oil.

The Tulare Formation reservoir system is complex with multiple fluid contacts for each sand layer. The oil reservoirs are typically positioned across the axis of the anticline and pinch out into mudstones or cemented sands off the flanks. The primary lithologic variable is mud content, which has influenced fluid distribution and affected fluid migration in the Tulare reservoir sands. Channelized alluvial fan and fluvial deposits are discontinuous with lenticular sands interbedded with delta plain mudstones. Mudstone units are more extensive than sandstones across the field. The individual sand beds of the Tulare Formation are laterally confined with respect to each other as evidenced by varying oil-water contacts. The complex depositional juxtaposition leads to individual reservoir systems.

Steam is typically injected into the sand zones to reduce the viscosity of the heavy oil. Cyclic steam operations are implemented early in the development to reduce oil viscosity and increase connectivity between oil producers and steam injectors. Oil production works to reduce pressure, enabling steam expansion. Later, steam drive operations, with a pattern of steam injectors and production wells, are drilled to evenly distribute the heat and increase production.

(Sections 6.4, 6.5, 6.6 and 7 omitted)

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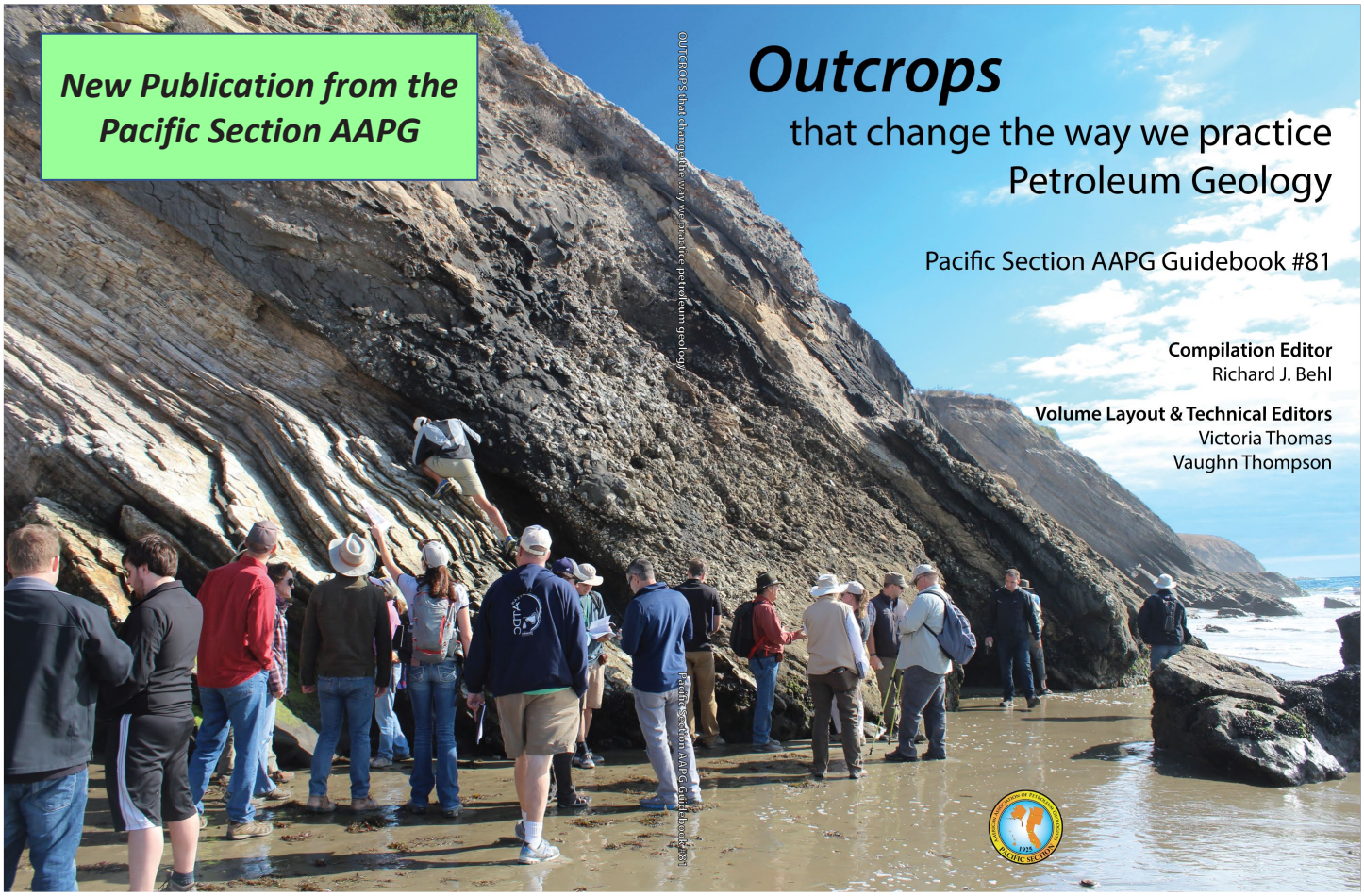

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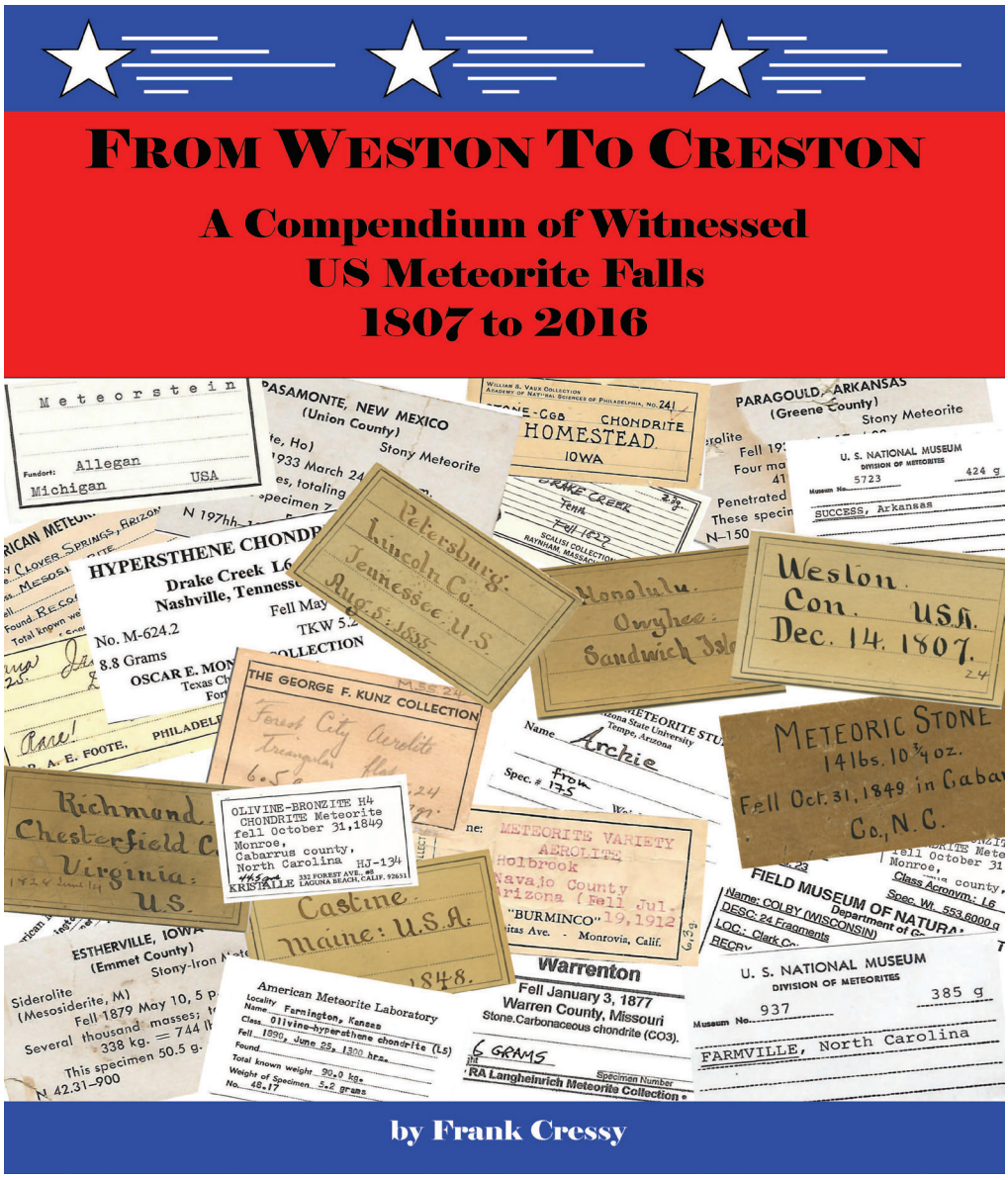

Update on Thomas E. Hopps Memorial Grant:

AAPG Foundation now accepting donations: https://donate.aapg.org/Core/eDonation.aspx/ Select Grants-in-aid Fund from Primary Fund Dropdown and select Thomas E. Hopps Memorial Grant in Sub Fund Dropdown Please contact Vaughn G. Thompson for additional information

Reprinted from the AAPG Explorer

Announcing the Thomas E. Hopps Memorial Grant
AAPG Foundation Team, March 2021

Thomas E. Hopps was a lifelong Californian who loved geology, loved working the Ventura Basin and other complex state structures and loved, especially, doing what he could to help others.

That help was often displayed in the way he shared his geologic knowledge and insights with teams on successful discoveries. Or in the way he advised and shared that same experience with people who wanted to make discoveries.

It was there in his helping students and young geologists as a mentor, or as a field trip leader, or as a passionate volunteer for committees throughout the Pacific Section.

Or as a philanthropist – a generous attribute that he willingly imparted with numerous charitable organizations. And now that legacy of helping others is about to add a new chapter: A new AAPG Foundation Named Grant-in-Aid is being funded in his name.

The Thomas E. Hopps Memorial Grant, initiated by his wife, Lydia Hopps, and his sons, Benjamin and Daniel, will be a memorial tribute to Hopps intended specifically for students in the AAPG Pacific Section.

The Foundation's Grants-in-Aid provides financial assistance to graduate students whose thesis research has application to the search for and development of petroleum and energy-mineral resources, and/or to related environmental geology issues.

Grants ranging from $500 to $3,000 are awarded annually to cover expenses directly related to the student's thesis work, such as field work or laboratory analyses. The grants are based on merit, financial needs and, in the case of the Hopps Grant, a specific connection to the Pacific Section.

Hopps' Legacy

Tom Hopps was an accomplished explorationist who loved the thrill of drilling and discovering oil – and whose ties to AAPG started early in his career. He joined AAPG in 1967 as a geology student at Cal State Long Beach, during which time he worked for Signal Hill Oil and Gas. His first job after graduation was as a field geologist for the Burlington Northern Railroad in Montana.

His life and career took a significant turn in 1971 – he married Lydia, a union that was celebrated for their entire life together, and together they moved to Ventura, Calif., where he began working for Argo Petroleum, creating the foundations for an exhilarating career in exploration.

With Argo he started building a geologic knowledge and expertise with basins throughout California, and in 1979 he launched his own consulting business – the first step toward he and Lydia forming Rancho Energy Consultants in 1982.

With Rancho Hopps became known as the "resident geological expert" of the Ventura Basin, producing maps, cross sections and interpretations that are still considered quintessential foundations for the area.

His most significant contribution then was the Ventura Basin Study, a relevant, data-rich document of historical importance.

His sharing of geologic expertise continued throughout his entire career through a prolific list of technical articles and basin studies in a variety of scientific journals.

But even as his career became increasingly successful, Hopps found time to be active in local and Section geological activities, serving in leadership roles (including president) for both the Coast Geological Society and AAPG's Pacific Section.

In 2000 he was awarded the Pacific Section's Honorary Life Membership award. To the end, Tom was an oil man and was planning delineation and development wells on his most recent successful discovery in the San Joaquin Basin. He was nearing completion of a co-authored publication on the Santa Barbara Channel when he passed in April 2020.

A memorial written last year for the Pacific Petroleum Geology Newsletter by AAPG Member Vaughn Thompson remembered him "kind-hearted and generous … Those whom he touched are lucky to have his bright spirit, forever running through him.

"He will be remembered by all those who will benefit from his legacy."

Preserving His Legacy

Contributing to the AAPG Foundation's Thomas E. Hopps Named Grant – and helping to ensure that his legacy lives on in the careers of student who share his love of geology – is an easy process.

One option: Simply go to the AAPG website, at Foundation.AAPG.org/Grants-in-Aid-Program.

Another way: Send an email to gia@aapg.org or to dkeim@aapg.org. Or call Diane Keim, AAPG administrative coordinator, at (918) 560-2644.

Either way, your gift will help geology students far into the future with the chance to pursue their geoscience dreams in the name of one who loved to help others. And helping others is something Thomas Hopps would have liked.

AAPG Editor's note: Vaughn G. Thompson provided material for this report.

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Anchorage, AK 99510

Check the website for the latest information on monthly meetings.

2022 Technical Conference: April 23, 2022, 8am-5pm at the Reichart Geology Building, UAF, .1930 Yukon Drive, Fairbanks, Alaska. Theme: Building of the Contributions of Pioneers in Alaska Geology. Attend online or in person. Check the website for registration information.

President:	Laura Gregersen	president@alaskageology.org
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Vice-President:	Ben Rickards	
Secretary:	Heather Beat	Heather.a.beat@gmail.com
Treasurer:	Corey Ramstad	cramstad@hilcorp.com
Past-President:	Andy Dewhurst	Andrew.Dewhurst@conocophillips.com

Coast Geological Society

www.coastgeologicalsociety.org

P. O. Box 3055
Ventura, CA 93006

In-person meetings return Tuesday April 19th, 2022. Meetings are the third Tuesday of the month and start at 6:30 pm.

Tuesday April 19: Student Scholarship and Presentation Night

President:	Renee Richards	president@coastgeologicalsociety.org
Vice President:	Jerry Nichols	vicepresident@coastgeologicalsociety.org
Secretary:	Justin Brochert	secretary@coastgeologicalsociety.org
Treasurer:	Blake Foreshee	treasurer@coastgeologicalsociety.org
Membership chair:	Eric Heaton	membership@coastgeologicalsociety.org
Webmaster/Tech Support:	John Abeid	webmaster@coastgeologicalsociety.org
Scholarship	Eiko Kitao	scholarship@coastgeologicalsociety.org
Logistics:	David Arellano	logistics@coastgeologicalsociety.org

Los Angeles Basin Geological Society

www.labgs.org

Virtual meetings continue at 12:00 noon the fourth Thursday of the month. Go to the LABGS web site for the link to join the meeting.

Check the website for information on the next talk.

President:	Scott Prior	figmo7@gte.net
Vice President	Nate Busch	NBusch@marathonpetroleum.com
Treasurer:	Francine Cason	fcason@gmail.com
Secretary:	Joseph Landeros	landerosjd@gmail.com
Scholarships:	Karla Tucker	ktkr2@aol.com
Webmaster	Joseph Landeros	landerosjd@gmail.com
Past-President:	Bert Vogler	hvogler@kleinfelder.com

(Continued on next page)

Northern California Geological Society

www.ncgeolsoc.org

803 Orion #2
Hercules, CA 94547-1938

Virtual meetings held via ZOOM at 6:30 pm on the fourth Wednesday of the month. Go to ncgeolsoc.org for more information.

April 27, 2022: Kim Jupiter, University of Victoria, CA, Seabed Mining

May 25, 2022: Dr. Alex Filippenko, U.C. Berkeley, A New Surprise in the Accelerating Expansion of the Universe

June 29, 2022: Dr. George Stanley, University of Montana Paleontology Center, Mass Extinctions

President:	Noelle Schoellkopf	NoellePrince @ sbcglobal.net
President-elect:	Jim O'Brient	
Past President:	Tom MacKinnon	tom.mackinnon@comcast.net
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Scholarships:	Phil Garbutt	plgarbutt@comcast.net
Program Director:	Jim O'Brient	
Website Editor:	Andrew Alden	geology @ andrewalden.com

Northwest Energy Association

www.nwenergy.us

P. O. Box 6679
Portland, OR 97228

Contact: Jim Jackson or John Armentrout

No activities are planned at this time. Check the website for the latest information.

President	Chris May	c.law.may@gmail.com
Vice-President	Steve Pappajohn	
Treasurer	Barb Portwood	bbportwood@gmail.com
Co-Treasurer	Jim Jackson	jackson.js@comcast.net
Secretary	Clark Niewendorp	clark.niewendorp@state.or.us

Sacramento Petroleum Association

P. O. Box 1844
Folsom, CA 95630

Contact: Pam Ceccarelli
916-439-0400

As of October 2021, in-person meeting have resumed at the Club Pheasant in West Sacramento. Meetings are held at noon on the third Wednesday of the month.

President:	Jerry Reedy	JWR5532@aol.com
Vice-President:	Scott Hector	Scott.Hector@gmail.com
Secretary	Derek Jones	djones@gasbiz.com
Editor/Treasurer	Pam Ceccarelli	pc626@comcast.net

(Continued on next page)

San Joaquin Geological Society
www.sanjoaquingeologicalsociety.org
P. O. Box 1056
Bakersfield, CA 93302
Contact: Mark Korte-Nahabedian
marknahabedian@gmail.com

In person monthly meeting have resumed. Meetings are on the second Tuesday of the month at 6:30 pm at the American Legion Hall, 2020 H Street, Bakersfield. Virtal attendence is an option.

Check the website for information on the next meeting.

President:	Jeff Kimber	Jeff.kimber@conservation.ca.gov
Past President:	Maia Davis	
President-Elect:	Jennifer Prosser	jprosser@envirotechteam.com
Vice-President:	Tom Howard	
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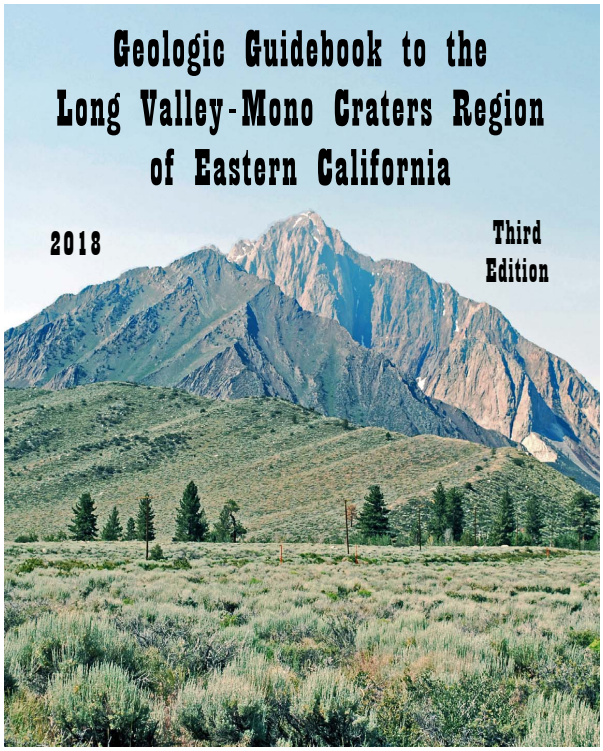

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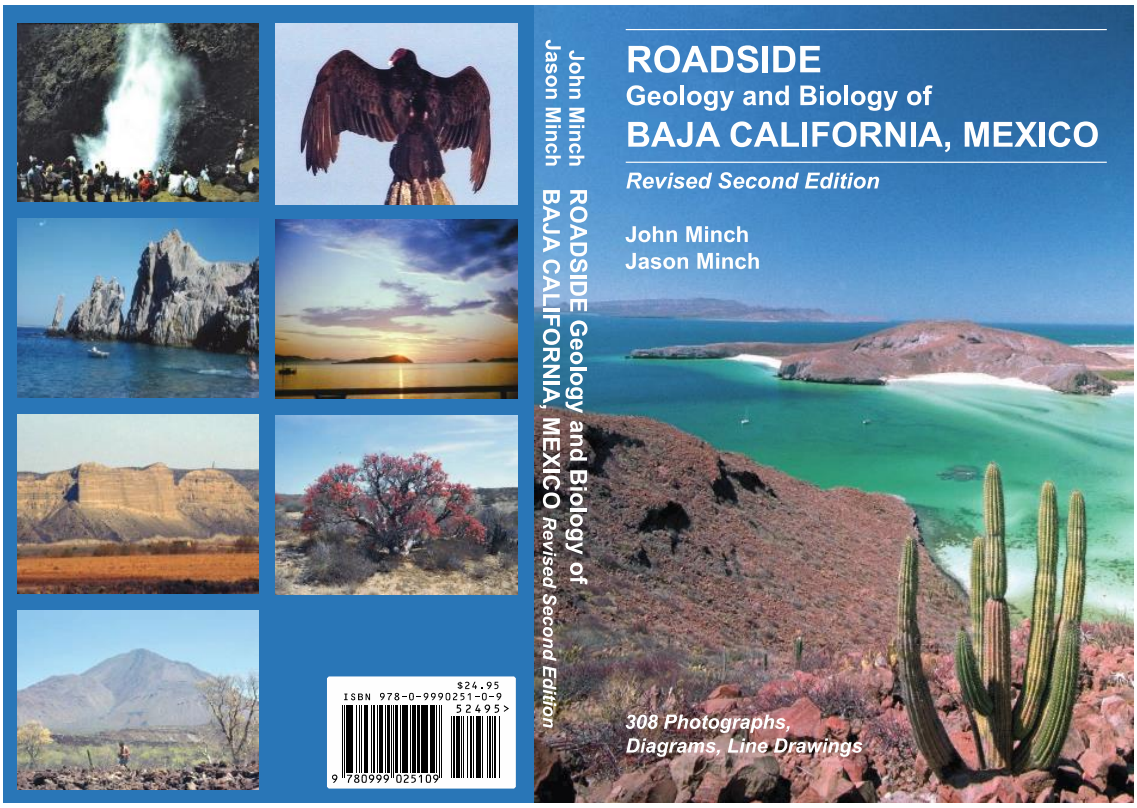

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