San Joaquin Geological Society

Date: **Tuesday, Jan 14th, 2025**

Time: **6:00 PM Social Hour**
6:30 PM Dinner
7:00 PM Lecture

Place: **American Legion Hall**
2020 H Street, Bakersfield, CA 93302

PSAAPG Members
$35 with reservation
$40 without reservation

Non PSAAPG Members
$40 with reservation

Full-time Students with ID
FREE!

**** RSVP ****

By: noon Monday, January 13th, 2025

Register online:
http://www.SanJoaquinGeologicalSociety.org/

Pay online *or* **cash/check** at the door

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Injection/production Behavior In Cyclic Steam Wells, And Their Implications To Surface Expressions And The Kinematic Evolution Of The Diatomite Reservoir

Presented by: Bill Bartling

Abstract: Oil Production on the West side of the San Joaquin Basin in California includes contribution from Miocene/Pliocene formations dominated by diatomaceous sediments. Diatomite reservoirs are produced using Cyclic Steaming. The wells are drilled in dense patterns as typically the fracturing and heating impacts of cyclic steaming are contained within 10's of feet of the wellbore, and due to the high porosity and high oil saturations and thus very high oil in place, the recoverable volume of oil within this radius is sufficient to payout these shallow, inexpensive wells. While in most cases the steam in the reservoir is controlled, there have been unexpected and uncontrolled high energy releases of steam, water and oil to the surface, known as surface expressions. These pose significant safety hazards to oilfield workers and in some cases, they release of large quantities of oil which causes sometimes significant environmental damage. Studies and oilfield remedial practices suggest that in most cases surface expressions are associated with or caused by damaged well bores or compromised cement in active, idle, and abandoned wells that provide a conduit for fluids and energy to near surface high permeability formations which can vent some distance from the leaking well, or directly to the surface at the damaged well. However, the mechanisms of long distance fluid propagation in the subsurface between injectors and conduits to the surface are not fully understood. This paper analyzes injection/production profiles and discusses surface expressions and potential causative mechanisms for subsurface fluid propagation to explain anomalies in these profiles, the distribution of surface expressions and a potential foundation for predicting and managing and thus avoiding future surface expressions. This study investigates the potential for kinematically induced fractures in the preunconformity strata, and if those fractures exist, estimate their location, distribution, orientation, and potential impacts on the reservoir behavior. Typical forward modeling of kinematic induced strain is difficult as previously stated, as most of the mapping in these fields was done on the post unconformity units and thus accurate cross sections and maps below the unconformity surface are generally unavailable except for work by Farley 2009 and others, and there were no detailed mapping studies identified specifically for the study area. The approach to the problem in this study is inverse from a typical kinematic analysis. That is, this study analyzes injection/production profiles to infer reservoir behavior at each well and from that, identifies populations of wells with similar behaviors that may indicate differences in reservoir properties and then spatially map them. Once done, kinematic models are referenced to assist in interpreting these maps and the maps incorporate data from post unconformity structural maps, and borehole geophysical analysis that samples both pre and post unconformity strata. Naturally fractured rocks are expected to display higher permeability and show longer pressure and reservoir connectivity away from the well than would an unfractured rock. Also, the response of a naturally fractured rock to cyclic steam stimulation, which in an unfractured rock creates small fractures near the well bore will be measurably different from that of an unfractured rock and these differences in rock fabric will be expressed in injection and production flow and mass balance data. The kinematic model employed as a foundation for this study predicts that naturally fractured and unfractured rocks will be spatially compartmentalized as a function of the rock's location and deformational history relative to active and passive axial surfaces in fault bend or fault propagation folds resultant from regional compression.

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