

Success! Using Seismic Attributes and Horizontal Drilling to Delineate and Exploit a Diagenetic Trap, Monterey Shale, San Joaquin Valley, CA.

Anne Grau, Robert Sterling, Robert Kidney
EOG Resources, Denver Colorado



Abstract:

The Miocene Monterey Formation of California's San Joaquin valley has long been recognized as a prolific source rock and underdeveloped resource. In this case study, the thick sequence of diatomaceous shales and hydrocarbon-rich sediments of the Miocene form a subtle diagenetic trap. As these sediments are buried to increasing depths, these siliceous shales convert from opal A to opal CT and finally to quartz-phase "chert", undergoing a significant change in porosity and other rock properties during this transition. Seismic data and modeling have been successfully utilized in the identification and mapping of these diagenetic facies.

North Shafter and Rose Oil Fields produce from a porous, hydrocarbon-charged reservoir that formed as a result of silica diagenesis and favorable timing of kerogen maturation in these sediments. The reservoir consists of fractured, porosity-enhanced, oil-saturated quartz-phase rocks. A trap is formed by the updip, opal CT-phase rocks that have no hydrocarbon saturation and poor porosity characteristics. The juxtaposition of these drastically different rock types is reflected by seismic amplitude anomalies that were used to determine the extent and shape of the fields.

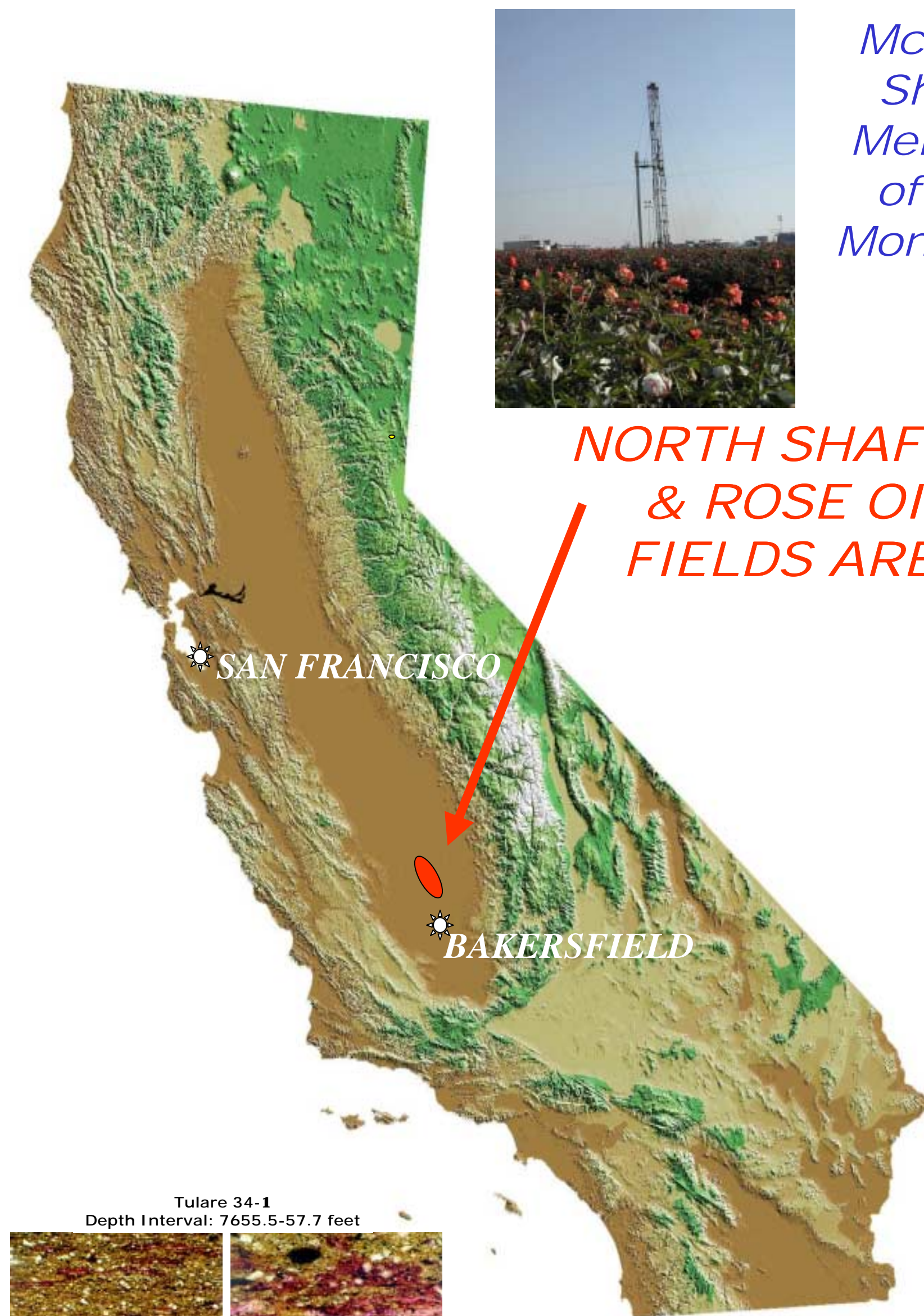
Horizontal drilling technology and strategic placement of wells have been key in the viability of this program. Close to 60 horizontal wells have been drilled in North Shafter and Rose oil fields since 1998, when the first horizontal well was drilled.

ACKNOWLEDGEMENTS

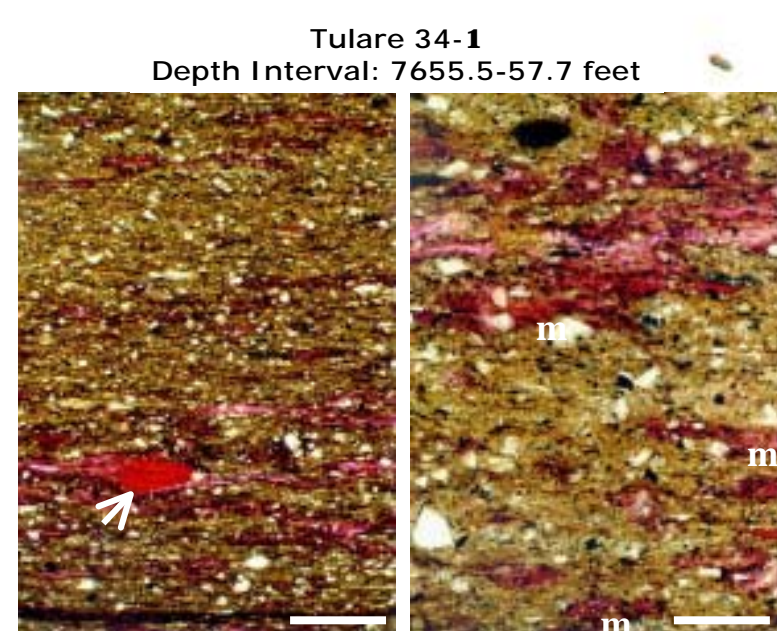
EOG RESOURCES:
Barbara Ganong, Chris Hanson, Paul Pendleton, Linda Hoagland, CB Lackey, Paul Connely

Texaco/Chevron:
Larry Drennan, Angela Bosse

Bob Barree, Laurie Williams



NORTH SHAFTER & ROSE OIL FIELDS AREA



Overview of texture and porosity in laminated mudstone. Clay-rich matrix hosts abundant silt, carbonaceous stringers, microfossils, and abundant phosphatic debris (arrow). Magenta epoxy fills several layer-parallel microcracks, some of which may be formed by core relaxation and dehydration. Clay matrix is comparatively tight. Scale bar = 0.5 mm. Plane-polarized light. (40x)

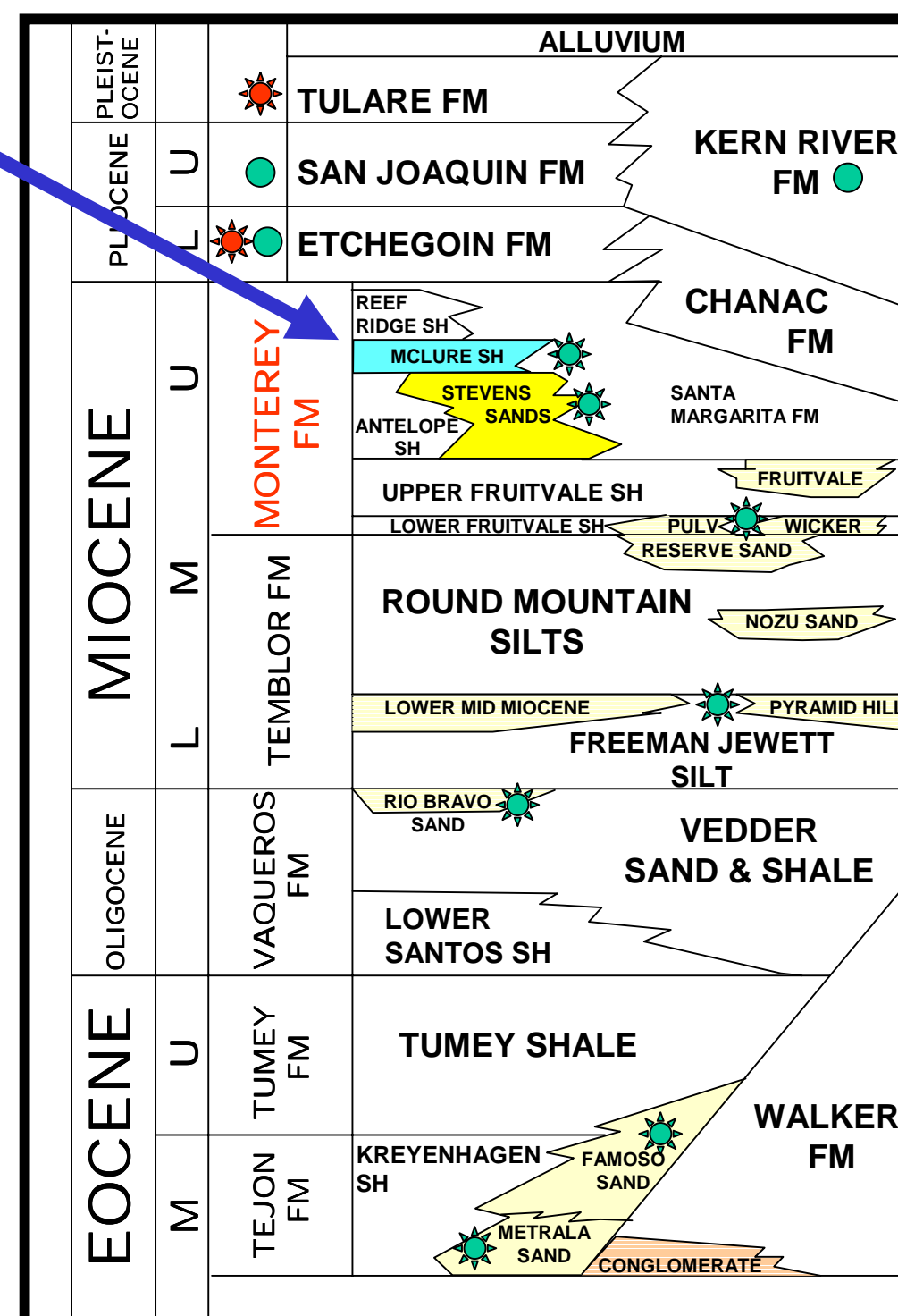
Higher-magnification view of silty mudstone texture illustrates an abundance of discontinuous, horizontal microfractures and patches of microporosity (magenta). Close examination reveals that these microporous lenses (m) are not as clayey and are presumably composed of micro- or cryptocrystalline silica. Microfractures at the top of view are likely induced by dehydration. Also note abundance of pyrite and carbonaceous debris. Scale bar = 0.2 mm. Plane-polarized light. (100x)

Heterogeneous Reservoir of Thinly-interbedded Diatomaceous Lithologies

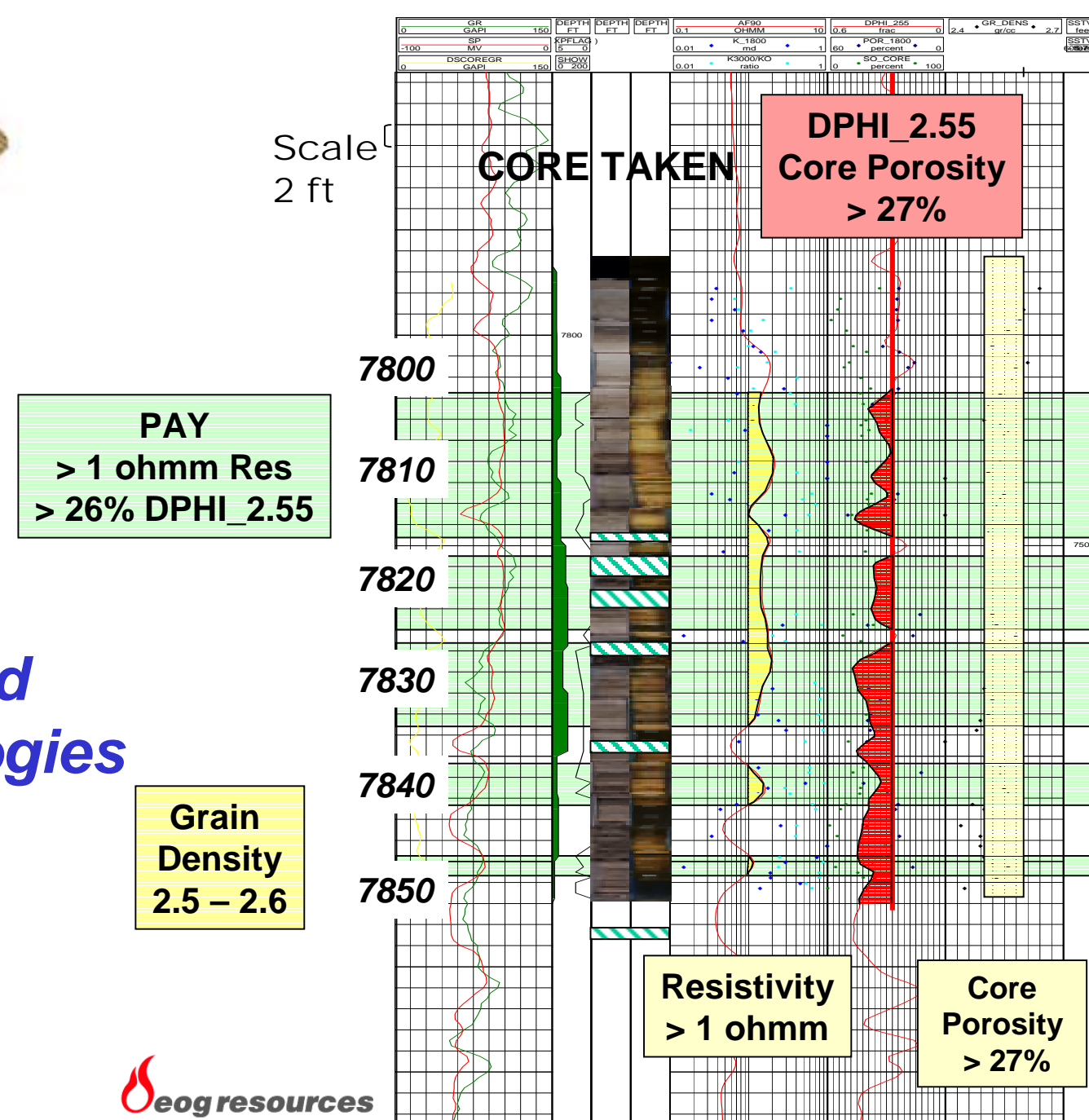
- Mudstone
- Porcellanite
- Diatomite
- Dolomite Siltstone

McLure Shale Member of the Monterey

STRATIGRAPHIC COLUMN SOUTHERN SAN JOAQUIN BASIN



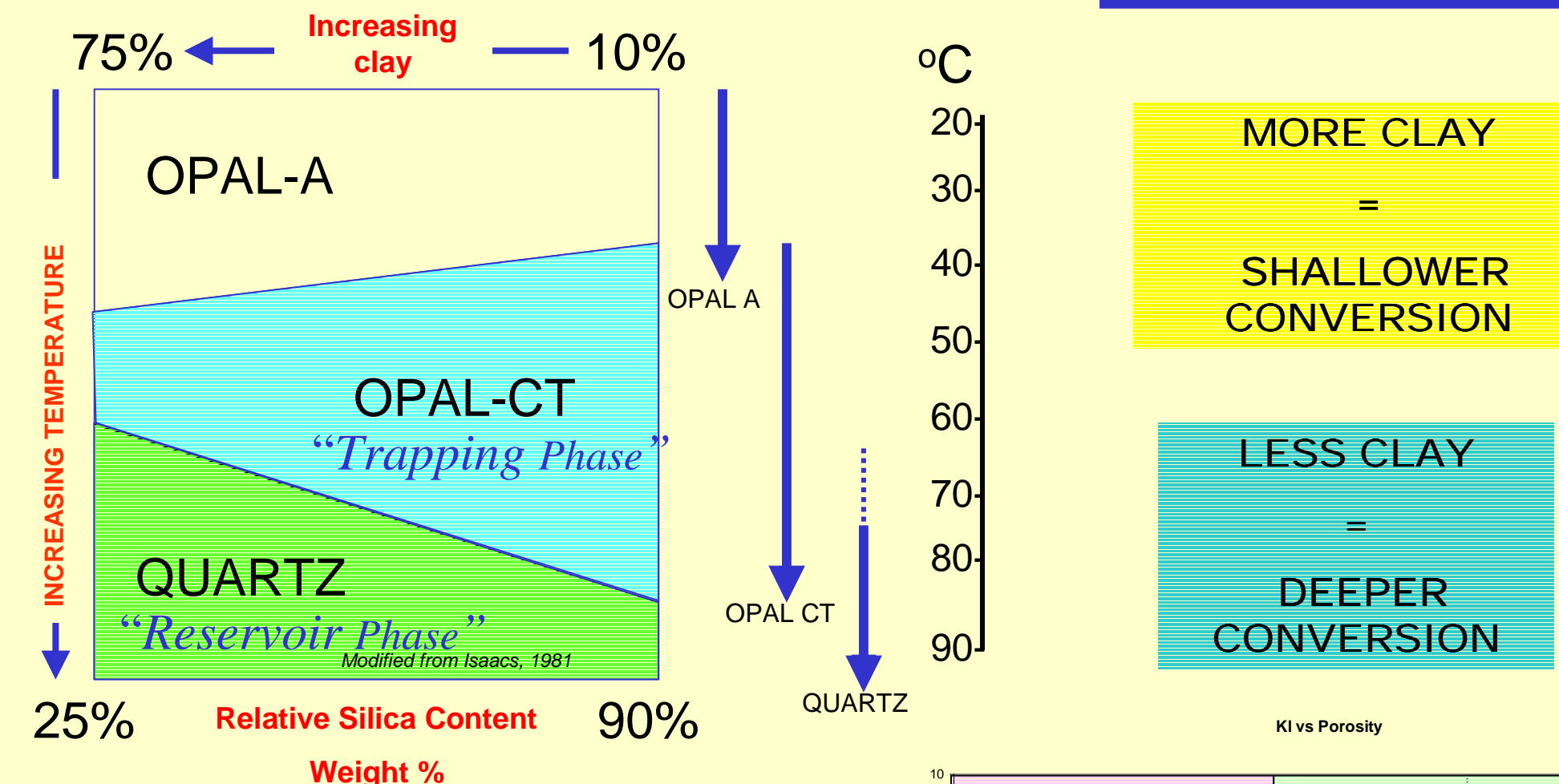
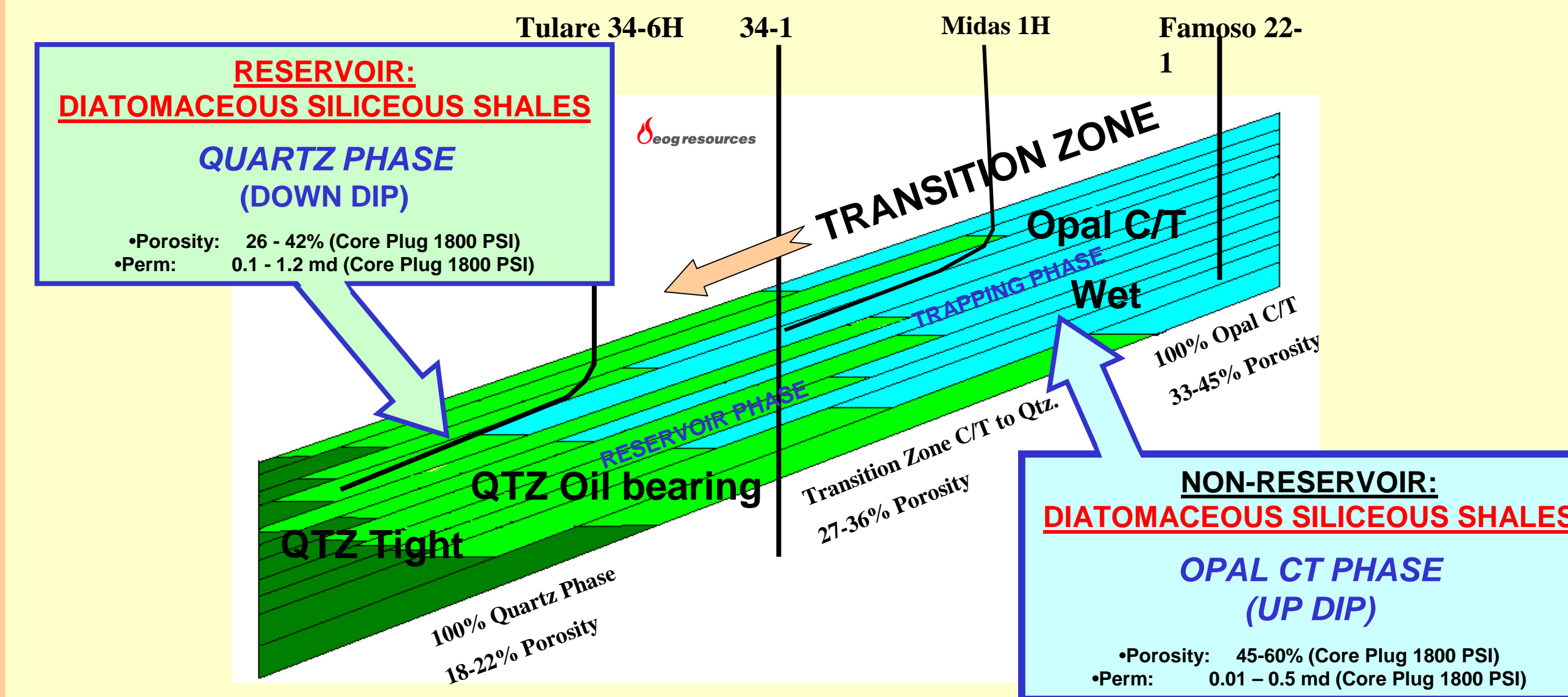
RESERVOIR CHARACTER



RESERVOIR CHARACTER & TRAPPING MECHANISMS

DIAGRAMATIC TRAP DESCRIPTION

Reservoir is created by down dip conversion from Opal CT to Quartz Phase rocks coeval with hydrocarbon charging



"DIAGENETIC TRAP"

