Chron C19r and C20n, based on a \(^{208}Ar/^{230}Ar\) date of 42.8±0.2 Ma in rocks of normal polarity (contrary to Bottjer et al., 1991, who correlated it with Chron C18n based on questionable P13 Zone planktonic foraminifera). These correlations contradict several sequence stratigraphic correlations of these strata. Conley et al. (1984a, 1986) and Marty (1987) and McFarland (1985) have noted that the Ffrans/Stadium contact with nanno zone CP15b and foramin zone P15 (about 36 Ma), but this clearly closely conflicts with the date on the overlying Mission Valley Formation by at least 6 million years.

Magnetic Stratigraphy of the Type Zemorrian Stage (Oligocene), Lower Temblor Formation, Temblor Range, Kern County, California

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Kleinpell (1938) erected the Zemorrian stage based on benthic foraminifera from the lower Temblor Formation in Zemorra Creek, southern Temblor Range, Kern County, California. The correlation of the Zemorrian stage with the standard time scale has long been controversial, although most authors have considered it to represent some part of the Oligocene. Paleomagnetic samples were taken from the type Zemorrian in and near Zemorra Creek. The magnetic directions passed both a fold and reversal test, and remanence seems to be held by both magnetite and hematite. The lowest members, the Cymric Shale and the overlying Wygal Sandstone, contain early Zemorrian foraminifera and were entirely reversed in polarity. Based on the occurrence of early Zemorrian fossils associated with P19 planktonic foraminifera in the San Lorenzo Formation, we correlate the Cymric and Wygal members with Chron C12r (31.0-33.3 Ma) and the lower Zemorran Sandstone producing a reversed-normal-reversed pattern that could correlate with four different magnetic sequences, since the age control is so poor. However, no matter how one correlates the various units, it is clear that a Zemorrian stage is incomplete and spans at most 2-3 million years of the 10 million years of the Oligocene (which lasts from 24.0 to 33.7 Ma).

Sub-Lakeview Sandstones, Midway-Sunset Oil Field

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The upper Miocene Sub-Lakeview sands of the Monterey Formation were deposited in a tectonically active deep marine setting. Individual sand units were deposited on small fans and in “gully” or channel fill deposits. The 10 to 300’ thick reservoir sands are composed of medium to fine-grained volcaniclastic sands. Sub-Lakeview Sandstones were deposited above the Spallacy/Monarch reservoirs and below the “N” point marker. Oil is generally trapped by the Top Miocene unconformity truncating individual sands on or near anticlinal features.

Production is often commingled with overlying and underlying sands, but individual sands locally form commercial accumulations. The Sub-Lakeview sands produce commercially on primary or with cyclic steam, they have also been steamflooded and fireflooded. The 12° to 22° API oil is often associated with primary gas caps near the updip edge of individual sand members. Development is on 3-D seismic data sets that have high reservoir definition.

Individual Sub-Lakeview pools continue to be discovered and developed at Midway-Sunset. Common techniques using old and new data are employed to improve and develop these accumulations. Other operators have used 3-D seismic to map several Sub-Lakeview channels that extend eastward from Midway-Sunset toward the center of the San Joaquin Valley.

THE COAST RANGE OPHIOLITE (CRO) DEBATE IS FRUSTRATED WITH COMPLIMENTARITIES AND INDETERMINACY - A FEW EXAMPLES

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Because we work primarily with rocks, we perhaps assume that our science is immune to complimentarities and indeterminacy. But these information-based limitations plague tectonic analysis as they do for any branch of science. An excellent discussion and unassailable (if possible) of the CRO debate (Dickinson et al., 1996) should have little trouble recognizing these limitations in the three views (V1, 2 & 3) expressed. Each view is dependent on missing geology. V1 requires the near total destruction of two opposing subduction complex-forearc systems along a Neovadian suture by subduction and/or erosion. V2 requires an unobserved subduction zone along the axis of the Great Valley. V3 appeals to total removal or burial of screens of older Sierran lithosphere from the outer edge or within the CRO. Each view has a data base of unassailable critical for the source of the Great Valley geophysical anomaly, yet basement cores from the area of the anomaly are primarily Early Cretaceous mafic bimodal rocks. V3 is predicated on forearc magmatism. This view is dismissed in V1 on the basis of forearc being cold and/or dynamic, yet V3 requires a regional basal basement.

The Middle Jurassic (pre-Neovad) plutons to have intruded the remnants of the juxtaposed subduction complexes. V1, 2 & 3 are all dependent on subducted slab-related geochemical tracers within the CRO, and on absolute age relations within the igneous sequences. A global survey of Neogene mafic systems reveals large uncertainties in the geochemical tracers, particularly when taking into account hydrothermal alteration and mantle metamorphism. Furthermore, Neogene arc systems show reorganization in magmatic loci and microplates at time scales comparable to typical uncertainties in absolute age determinations.

Critical stratigraphic, structural, and timing relations within the western Sierra Nevada, California, and their bearing on models for origin of the Foothills terrain and the Great Valley basin

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Several models exist for Jurassic-Cretaceous evolution of the western Sierra Nevada, the adjacent Great Valley basin, and the Coast Range ophiolite, as recently clarified by Dickinson and others (1996). To evaluate the models requires both an examination of critical stratigraphic and structural relations within the western Sierra Nevada, and an understanding of predictions or requirements of the various models (e.g., can any model be falsified by reliable data?).

In some cases, reliable data may contradict a model, but not rule it out, and the model can be made more complex, such as invoking noncollisional, intracratonal deformation along a convergent margin. However, any model whose predictions can be falsified by, or whose requirements are incompatible with, reliable data probably should be eliminated.

Within the western Sierra Nevada, controversy surrounds many of the units, largely because uncertainty exists about correlations and links between units, their probable tectonic significance and ages, and the timing of styles of deformational events and structural elements. This paper reviews and summarizes new and published stratigraphic, structural, and timing relations, to evaluate which are well established, and to highlight critical uncertainties and unknowns. Well-established relations are compared with predictions of various models, both to determine if any models are incompatible with or can be falsified by reliable data, and to suggest important future tests of the models.

Capture of Bypassed Oil in a Steeply Dipping, Thick-Bedded Turbidite Reservoir Using Horizontal Wells: A Pilot Project from the Monarch Heavy Oil Reservoir, South Midway-Sunset Field, California

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Steeply dipping, heterogeneous reservoirs provide unique geometric opportunities for horizontal well development. Realizing optimum drainage in such areas using conventional vertical technology is not always successful due to significant stream override and lack of downstream take-points. Specifically, multiple wedges of bypassed oil can occur (structurally higher than the uppermost injection well) and downflood (structurally below the lowest producing well). As such, horizontal wells drilled normal to strike and slightly above low S, zones or oil-water contacts can be used to capture the bypassed reserves.

The Monarch heavy-oil reservoir is an extremely heterogeneous, thick-bedded turbidite deposit with gross reservoir thicknesses ranging from 500' to 1000', and net pay ranging from approximately 200' to 450'. The SW portion of the field is characterized by steeply dipping beds (40° to 60° NE), which intersect a relatively flat transitional fluid zone (i.e., S, = 10% to 30%). This steeply dipping area, along with horizontal wedges of updip and downdip bypassed oil, were identified and mapped. To capture the bypass, Mobil drilled 5 long radius horizontal wells normal to strike situated 10' to 50' above the transitional fluid zone. Later completion lengths for these wells ranged from 750 to 850. This orientation allowed the wells to drain multiple packages of the reservoir independently. The horizontal wells were a function of 1) placement of horizontal well relative to the transitional fluid zone; 2) reservoir temperature, and 3) volume of the bypassed oil wedge.

Exploration and Development of the Upper Cretaceous Blewett Trend, Northern San Joaquin Valley, California

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One of the more active exploration areas of California for the past seven years has been the Blewett trend of the Northern San Joaquin Valley. This deep water sand trend extends from Gill Ranch gas field to Vernalis gas field, over sixty miles in length. Recent exploration activity has been focused in the San Joaquin Valley, where a number of gas fields have been developed in the upper Cretaceous Blewett Formation, west of Gill Ranch, Moffit and Chowchilla gas fields.

Unocal initiated the interest with the O’Banion #1, located in section 25, T11S R13E, M&BSM. The well was drilled in July 1980, and encountered approximately 80’ of gross gas sand in the top of the Blewett formation, at a depth of 6527 KB. The Merrill Avenue discovery confirmed the geophysical interpretation of a seismic anomaly identified on aerial line 2N-25. The gas appears to be trapped on a faulted nose dipping southwest, additional drilling to develop the field, however, met with limited success. First production began on October 1991, after the construction of a 30 mile pipeline.

McFarland Energy and partners obtained a significant acreage position north of the discovery. McFarland drilled the Wolfsen #1-10, in March of 1992, about 3 miles northwest of Unocal’s O’Banion #1. The well encountered 54 gross blewett gas sand on water. Additional drilling, based on identification of geophysical anomalies in the Blewett and with a number of success in the trend, Mert Road, Bluff Creek, and Creme, have been drilled. Production data from all recent Wells indicates most wells to have recoveries from 0.5-1.0 BCFG. A few wells have produced greater than 1.0 BCFG, and only the O’Banion #1 has produced in excess of 10.0 BCFG.

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