Chrons C19r and C20n, based on a $^{40}Ar/^{39}Ar$ date of 42.83 ± 0.24 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. May et al. (1984), May (1985) and May and Warme (1987) correlated the Friars/Stadium contact with nanno zone CP15b and foram zone P15 (about 36 Ma), but this clearly clearly 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 (31.0-33.0 Ma). The late Zemorrian Santos Shale and Agua Sandstone produce 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 interprets the correlation, it is clear that the type Zemorrian is very 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 units are composed of medium to fine grained arkosic sands. The Sub-Lakeview sands were deposited above the Spellacy/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 ½ to 2½ acre spacing with high recoveries due to good gravity drainage.

Individual Sub-Lakeview pools continue to be discovered and developed at Midway-Sunset. Common techniques using old and new data are employed to high-grade prospective targets and reduce the number of dry holes associated with development of the laterally restricted sand accumulations. Driller's logs and old E-logs form the backbone of company data sets and are key to highlighting areas of interest. Wet sands are often difficult to recognize with resistivity logs alone, but porosity logs clearly show sand presence. Berry's use of stratigraphic dipmeter interpretation has significantly reduced the number of dryholes drilled developing 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 FRAUGHT 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 complimentarity and indeterminacy. But these information-based limitations plague tectonic analysis as they do for any branch of science. An educated and unbiased (if possible) observer 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 Nevadan suture by subduction and/or erosion. V2 requires an unobservable 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 different pre-Cretaceous origin for the source of the Great Valley geophysical anomaly, yet basement cores from the area of the anomaly are primarily Early Cretaceous mafic batholithic rocks. V3 is predicated on forearc magmatism. This view is dismissed in V1 on the basis of forearcs being cold and amagmatic, yet V1 requires a regional belt of Middle Jurassic (pre-Nevadan) 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 magma systems reveals large uncertainties in the geochemical tracers, particularly when taking into account hydrothermal alteration and mantle metasomatism. 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 terrane 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 the Coast Ranges (a data quality issue), 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, intraarc contractional 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 metamorphic belt and in isolated pendants in the southwestern Sierra, 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 and 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 downdip take-points. Specifically, multiple wedges of bypassed oil can occur updip (structurally higher than the uppermost injection well) and downdip (structurally below the lowest producing well). As such, horizontal wells drilled normal to strike and slightly above low S_o 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 thickness 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_o = 10% to 30%). In this steeply dipping area, multiple 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. Lateral completion lengths for these wells ranged from 750' to 950'. This orientation allowed the wells to drain most parts of the reservoir irrespective of vertical stratigraphic barriers. In general, oil rates 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 southern third of the trend where significant reserves of gas have been developed in the upper Cretaceous Blewett Formation, west of Gill Ranch, Moffat and Chowchilla gas fields.

Unocal initiated the interest with the O'Banion #1, located in section 25, T11S/R13E, MDB&M. The well was drilled in July 1989, and encountered approximately 80' of gross gas sand in the top of the Blewett formation, at a depth of 6520' KB. The Merrill Avenue discovery confirmed the geophysical interpretation of a seismic anomaly identified on several seismic lines. 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 Wolfson #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 met with a high degree of success in the Merrill Avenue, Mint Road, and Ash Slough gas fields. 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.