County, has revealed a complex history. The presence of abundant freshwater microfossils (megaspores, chrysomonad cysts, diatoms, sponge spicules), together with only limited evidence of authigenesis, indicates that most of the claystone originated as detrital clay deposited in shallow ponds or marshes. Weathered horizons, at least one of which may represent a remnant of a fossil soil, and other evidence of surficial processes, such as root tubes (and roots) and nearly ubiquitous illuvial-clay coatings in pores, indicate that the ponds dried up periodically.

The dominant claystone lithofacies of the Valley Springs Formation, together with interbedded fine-grained sandstone (channel deposits?) and tuff, can be interpreted as the deposits of a poorly drained coastal plain that was occasionally blanketed by ash deposits and that extended westward from the present Sierra Nevada foothills to at least the present Coast Ranges foothills.

BAUR, M. E., H. I. HALPERN, and I. R. KAPLAN, Univ. California, Los Angeles, CA

Reaction Kinetics of Laboratory-Simulated Kerogen Maturation

Application of time and temperature evaluations to maturation and hydrocarbon formation requires knowledge of the chemical kinetics of the maturation process. Lopatin and others have used first-order kinetics, assuming linear dependence of maturation on time for a given temperature and have derived a rate constant whose temperature dependence is governed by the Arrhenius equation. This model may be inadequate as maturation data used in such first-order kinetic equations have generally yielded Arrhenius factor activation energies which vary widely with temperature.

We report here a detailed kinetic analysis of the laboratory-simulated maturation of several distinct kerogens having different source organic compositions and utilizing data for the production of CO_2, CH_4, and higher hydrocarbon gases as a function of time and temperature. In all cases, the dependence of maturation on time departs from linearity. Empirically a dependence on $t^{1/2}$ gives the best fit to the data, indicating possible product inhibition of the maturation process. We develop a simple chain reaction model incorporating this feature for both short and long reaction times. The model yields an effective rate constant which should obey the Arrhenius equation and consistently gives temperature-independent composite activation energies of the same approximate magnitude as is implied by Lopatin's model. The nature of the mineral substrate present with the kerogen influences the rate of maturation, both directly by catalytic action in some cases and indirectly by adsorption of product.

Our results suggest a marked difference in kerogen maturation kinetics between closed and open systems, which must be considered in interpreting and comparing laboratory simulations and which may be of considerable significance for hydrocarbon genesis in the field. This may be reflected in a dependence of the kinetics on lithology and porosity of the source or rock unit.

BERRY, K. D., Chevron, U.S.A. Inc., Concord, CA

New Age Determinations in Franciscan Limestone Blocks, Northern California

This paper documents age assignments for two widely separated and isolated northern California Franciscan "formation" limestone pods that have not previously been reported in published literature. These assignments, the first definite early Eocene fauna thus far recognized, and the most northeasterly occurrence of a Late Cretaceous Cenomanian stage fauna, were made by examining planktonic Foraminifera in thin sections.

In northern California, the Franciscan is divided into three broad northwest-trending belts: an eastern metamorphic belt, a central melange belt, and a western and youngest coastal belt. The occurrences of *Rotalipora appenninica, R. cushmani, Praeglobotruncana stephani,* and *P. stephani* var. *turbinata* in a limestone pod in the melange belt, about 10 mi (16 km) east of Covelo, indicate a Late Cretaceous (Cenomanian) age. Other limestone blocks in the same area contain Late Jurassic (Tithonian) megafossils.

In the coastal belt, a limestone pod from an abandoned quicksilver mine about 6 mi (10 km) north of Branscomb includes *Globorotalia subbotinae = G. rex, G. aragonensis, G. caucasica?* and *G. pseudotopilensis,* indicative of an early Eocene age.

BJORLYKKE, KNUT O., Univ. California, Santa Barbara, CA

Sandstone Diagenesis as Function of Depositional Environment and Plate Tectonic Setting—Comparison Between Jurassic Sandstones from North Sea Basin and Some Oligocene Sandstones from Coast Ranges of California

Jurassic sandstones from the North Sea and Oligocene sandstones from the Coast Ranges of California are characterized by very different diagenetic mineral composition, which can be explained by differences in source rocks, sedimentary facies, climate, and ultimately in terms of plate-tectonic setting. The Jurassic sandstones from the North Sea were deposited in a rifted basin and were mostly derived from uplifted Precambrian terrane. A high content of diagenetic kaolinite in these sandstones can be attributed to meteoric water flushing through fluvial and deltaic sediments, causing the breakdown of feldspar and mica and the formation of kaolinite. Montmorillonite and zeolites are rare as authigenic minerals in these sandstones. In California, the rapid subsidence of the basins in this subduction regime caused marine sandstone facies to predominate. These sandstones contain smaller amounts of kaolinite, probably because they did not experience any strong flushing by meteoric water after deposition. In addition, a drier climate in this region explains why fluvial sandstones such as the Sespe Formation show less evidence of meteoric water diagenesis than the Jurassic North Sea sandstones. Basin subsidence and marine transgression after the deposition of the Sespe Formation also limited the time these sandstones were exposed to meteoric water and thereby the formation of kaolinite. A higher content of mafic clastic minerals and chert, which formed unstable mineral assemblages in the California sandstones, favored extensive growth of diagenetic montmorillonite.

CHUN, JOONG H., and CHESTER A. JACEWITZ, Seismograph Service Corp., Tulsa, OK

Weathering Statics Problem and First-Arrival Time Surfaces

Where organized by shot and receiver coordinates, the collection of picks of the first arrivals forms a jagged surface. It is thus crucial that the properties of the time surface of first arrivals be studied for various situations. It is particularly useful to