analytical sophistication of organic geochemistry and the application of organic geochemistry to better evaluating risks when making exploration decisions. Unfortunately, the applications available from present technology have not been fully exploited. Thus, a major frontier exists in the increased exploitation of presently available technology. This frontier can best be exploited by placing an experienced exploration geologist, with an interest in organic geochemistry and basin analysis, between the chemist in the lab and the exploration manager.

Meanwhile, technology improves and new opportunities appear, although we will probably be dealing with incremental improvements, not the conceptual breakthroughs of the past 20 years. Anticipated developments include the following. (1) Finer tuning of the "generation window" for different types of organic matter, generation products, and rock matrices. (2) Better generation, migration, and accumulation models. Many numbers are multiplied together in these models, thereby leading to large uncertainties in the final prediction. Geochemistry will help better define such models in several ways; however, its major contribution will probably be in the increased accuracy and numbers of measurements of the actual distribution of hydrocarbons and other organic compounds in the subsurface. More such data are sorely needed to increase our ability to quantitatively evaluate migration mechanisms. Most of the oil and gas remains in the potential source rock. Better understanding of when, how, and why some of it does move is clearly an important frontier. (3) Improved prediction of source rock distribution, type, thickness, and maturity. This will be accomplished by integrating organic geochemistry with modern and paleo-oceanography, paleoclimatology, and plate tectonics. By better understanding why source rocks are where they are, we will better predict where others might exist, and conversely, where they are not to be expected. (4) Increased efforts to apply "biomarker" geochemistry to exploration problems. (5) More sophisticated, non-"biomarker," methods for characterizing oils. These will lead to better oil-oil and oil-source correlations for use in exploration, but will also be increasingly applied to a variety of development and production problems. (6) Increased studies of interactions between organic matter, rocks, and fluids. In the past, the prime interest was in the effects of different rock matrices on organic maturation rates. Results have been disappointing, perhaps because the major effects are in the other direction. Organic matter and its decomposition products can have a major effect on rock diagenesis and sedimentary ore deposits. (7) The geochemistry of deep, hot, gas accumulations.

This list is not exhaustive. Opportunities abound for the application of geochemistry to exploration problems. The technology exist, or soon will. The frontier is how well the resourcefulness of our profession will be used to apply the available technology to our problems.

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A Discussion of Crude Oil Production Potential in Alaska and California

Nearly half of the proved oil reserves in the United States are located in Alaska and California. In 1980, production from this 14 billion bbl reserve base averaged nearly 2.6 million BOPD or roughly 30% of total United States production. Although there is little doubt that Alaska's and California's future contributed to total United States production will increase, a great deal of uncertainty exists concerning the magnitude of this contribution.

A range of forecasted production values is presented for Alaska and California. The forecast reveals that there is a 67% spread between the high and low boundaries of California's production potential during the mid 1990s; this range is even greater (167%) in the case of Alaska.

The forecast is accompanied by a comprehensive discussion of factors that will determine actual production. These factors are organized into three groups: exploration success, market conditions, and regulatory environment. The first, exploration success, is described in terms of geologic prospects, lease sale timing, technology performance in harsh frontier environments, and economic risk in comparison to other regions. The second group comprises factors affecting petroleum company perception of future West Coast market conditions. Forecasts of refined product demand, crude supply potential, and refinery configuration are presented to help define this perception. The third group, future state and federal regulatory environments, is discussed from the perspective of conflicts between state and federal outer continental shelf operational jurisdiction, potential governmental responses to serious accidents, and policies concerning taxes, royalties, and crude exports.

This information will help petroleum companies formulate crude exploration, development, production and processing plans based on personal perceptions of the future.

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Brines, Clay Minerals, and Equilibria: Predicting Diagenetic History and Reservoir Quality in Oligocene Frio Formation of Texas

Sandstone reservoirs of good quality, displaying abundant deep secondary porosity, exist on the upper Texas coast, whereas secondary porosity and permeability in sandstones of the lower coast are occluded by authigenic ferroan calcite and chlorite. This difference in regional reservoir quality is controlled by bulk mineralogy, temperature, pressure, and pore-fluid chemistry. Concentrations and activities of major species show depth dependent trends that correspond to pore pressure gradients and associated thermal gradients. Salinities decrease near the base of hydropressure, but increase at intermediate pressure gradients between 0.465 and 0.7 psi/ft (10.5 and 15.8 kPa/m). At higher pressure gradients salinities decrease with depth. The Ca/Na ratio is lowest at top of geopressure. Predictions from solution-mineral equilibria using approximately 130 analyses of Frio brines add new insight on relative mineral stabilities and in-situ pH, and are consistent with the diagenetic sequence developed from petrographic data. Kaolinite is stable in geopressured waters relative to Ca-montmorillonite and plagioclase; it is abundant on the upper coast as a late stage cement. Lower temperature and in-situ pH (high P_{CO_2}) explain the general absence of chlorite on the upper coast; its formation on the lower coast is promoted by higher temperature, a mineralogy rich in volcanic and carbonate detritus, and inferred higher pH. The key to predicting reservoir quality at depth is the deep hydropressured waters. Activity indices are indicators of reservoir quality. Waters of the lower coast plot more deeply into the stability field of chlorite than do those of the upper coast.

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Egyptian Exploration: Background, Models, and Future Potential

Egypt has proven to be an area with excellent exploration