gymnospermic pollen grains, a few Hystrichospheres and Dinoflagellates) is presented.

Evolutionary trends of the associations and lateral variations and environmental influences are discussed. Choice of stratigraphical characteristics and zonation of the series, which have an aggregate thickness of several thousand meters, are indicated. Correlation is made between wells at distances extending to as much as 600 kilometers and across various deposits of continental, brackish, and marine facies.

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SEDIMENTARY BASINS AND EXPLORATION FOR OIL AND GAS IN CALIFORNIA

California is one of the prolific oil and gas producing provinces of the United States. To date 12,350,000,000 barrels of oil and 17,122,000,000 MCF of gas have been produced. Estimated oil reserves are 3,550,000,000 barrels and estimated gas reserves 8,822,000,000 MCF.

The six important oil-producing sedimentary basins with estimated ultimate proved production are: (1) San Joaquin, 7,270,000,000 barrels; (2) Los Angeles, 6,070,000,000 barrels; (3) Ventura, 1,919,000,000 barrels; (4) Santa Maria, 684,000,000 barrels; (5) Cuyama, 375,000,000 barrels; (6) Salinas, 225,000,000 barrels. The most important dry gas producing basin, the Sacramento, has an estimated ultimate recovery of 4,800,000,000 MCF.

These basins are aligned in a general northwest-southeast trend paralleling the mountain systems of California. The San Joaquin basin with 10,000 square miles is the largest and the Los Angeles basin with 700 square miles is the smallest. The east-west-trending Ventura basin lays claim to being the narrowest and yet the deepest with approximately 60,000 feet of sediments in the synclinal trough. The sedimentary section in these basins ranges from Upper Cretaceous through Quaternary. Intensive folding, thrust faulting, and abrupt facies changes are common. Most of the oil fields are anticlinal and are characterized by high productivity per acre. Sandstones are the predominant reservoirs with Miocene (48%) and Pliocene (41.6%) accounting for most of California's oil.

California's first commercial oil field was discovered in 1898. The peak discovery years were the twenties when a plethora of new fields flooded the market and resulted in the first curtailment program. The advent of the seismograph in the thirties was followed by major discoveries. During the last 20 years, with the exception of 1948 and 1949, it has been a struggle to maintain reserves. Economic factors, including the increased cost of drilling to deeper objectives, higher royalties and land costs, expanding suburban development and the flood of foreign imports have become deterrents to many operators.

Despite this somewhat darkening picture there remain substantial parts of California's sedimentary basins that have not been adequately prospected and which should contain profitable oil and (or) gas accumulations. Provided with the opportunity, imaginative and aggressive geologists can keep California in the "prolific producing" category.

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APPLIED PALEOZOIC PALYNOLOGY

Delineation of specific segments of the Paleozoic geological column by palynological methods is based on the concept that plant composition throughout geological time underwent changes that are recorded in the recoverable spores and pollen grains. These changes are largely the result of plant evolution and paleoecology.

The application of Paleozoic palynology originated 32 years ago with attempts to correlate economically important coals. In subsequent years, palynological data have been used in correlation studies of other strata, both non-marine and marine.

Separate thresholds of guide fossils are required when plant microfossils from different environments are compared in attempting to establish correlation lines. The coal-swamp environment, at a given point in time, has a particular set of fossils not necessarily duplicated in other non-marine environments elsewhere.

In recent years, palynological data have become available from many localities throughout the world. From these data it is possible to evaluate selected taxa potentially useful for correlation studies.

Palynology has certain limitations inherent to the science and others common to biological methods of correlation. Although palynology can not be used in every correlation problem, it has been useful and practical for parts of the geological column, in some cases after other biological methods have failed to be definitive.

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COMPUTER ANALYSIS OF STRATIGRAPHIC MAPS

Stratigraphic maps, such as structure, isopach, and facies maps, are commonly prepared as contour-type maps from measurement data obtained in wells and outcrops. In recent years geologists have experimented with methods for extracting additional information from these maps by application of various mathematical and statistical procedures. Most of the methods are very time-consuming and do not justify their cost as routine procedures without high-speed computers. The advent of computers has made possible a change in the entire framework of map preparation, analysis, and interpretation by furnishing quicker ways of assembling, storing, and processing the basic data. In this respect the computer and associated equipment act as a super-speed desk calculator and filing system that frees the geologist from much busy-work and gives him more time to interpret and use his final maps.

Among problems that can be examined conveniently with the aid of computers are similarities or differences among maps; the use of maps as predicting devices; and the more general question of setting up criteria for the selection of mappable variables that will give the most information per dollar in terms of the objectives of the map study.

Map comparison and the use of maps as predicting devices can be achieved at reasonable cost by trend surface analysis, by which the "observed" map data can be separated into two main parts—the trend surface that represents the broad areal changes in the mapped variable, and the deviations from the trend that represent small-scale local or anomalous variations. Sometimes the trend surface is of major importance in a study, but in some applications the deviations may rise to major importance. Selection of particular aspects for stratigraphic mapping can be approached in several ways—by regression procedures that "sort out" the important mappable variables; by multiple correlation procedures; or by use of factor analysis that identifies certain groups of variables as being of first-rank importance in the context of a map study.

Emphasis in this paper is on some principles that underlie map analysis, illustrated by sequential trend analysis of map data. The influence of open and closed number systems—rock thicknesses in contrast to per-