

laminae; also, portions of it are cross-laminated. This berm and its internal structure are a result of sedimentation during the flood- to ebb-tide period.

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COILING DIRECTION RATIOS OF FORAMINIFERA
Globigerina pachyderma (EHRENBURG) IN
NORTHEASTERN PACIFIC SURFACE SEDIMENTS

Coiling direction ratios of *Globigerina pachyderma* (Ehrenberg) plotted for sediment surface samples from the northeastern Pacific north of 40°N. did not show the consistent relationship which would recommend them as reliable guides for deep-sea core analysis in this region. A generally increasing tendency for sinistral coiling toward the north was noted, from 13 per cent left reported by Parker (1962) from a nearshore sample (40°N.) to a consistent 95-100 per cent left in the northern Gulf of Alaska. Great irregularity in coiling ratios in seaward (east-west) traverses may be related to a nearshore area of warm-water intrusion (Fleming, 1958) affecting the type of plankton supplied to the substrate. Variations from 20-96 per cent left coiling were observed in these traverses. Dextral coiling percentage usually was higher in samples containing many species and few individuals. The "recency" of the surface sample also affected the coiling ratios. The problem of distinguishing small *Globobulimina* *dulterrei* (d'Orbigny)—predominantly right coiling—from *Globigerina pachyderma* (coiling in question) may qualify coiling ratios reported by various authors. Plankton tow samples off Oregon, Washington, and the Aleutian Islands had smaller percentages of *G. pachyderma* and higher dextral ratios than samples from the underlying sediment surface.

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ARCHEOPYLE IN FOSSIL DINOFLAGELLATES

Fossil dinoflagellates, the most important marine component of many Mesozoic-Tertiary palynological preparations, are remains of chiefly planktonic organisms. Commonly abundant and well preserved, they can be highly useful in problems of local, regional, and interregional dating and correlation. They have been used less than their potential warrants, at least partly because the unalerted eye, bewildered by the variety of their more spectacular structures, readily overlooks others of greater diagnostic value. This paper draws attention to one morphological feature of fossil dinoflagellates, the archeopyle, a distinctive opening in the test which is usually easy to see and is a significant aid in distinguishing among stratigraphically important genera and species.

The archeopyle is formed through release of an operculum along the primary archeopyle suture. The operculum is simple when it consists of a single piece and compound when it is divided into two or more parts by secondary archeopyle sutures; it is free when the primary archeopyle suture completely surrounds it and attached when that suture does not close on itself. Archeopyle shape and position relate to the basic pattern of plate arrangement, or tabulation, which is one of the striking features of dinoflagellates. Accordingly, an archeopyle may be apical, intercalary, precingular, or epithecal, depending upon the part of the test involved in its formation. In all, about 10 distinctive archeopyle

types have been recognized. Some fossil dinoflagellates lack an archeopyle entirely and a few have openings of combined types or of types that do not fit readily into a simple classification.

Careful observation of the archeopyle is prerequisite for precise and consistent identification of fossil dinoflagellates. Besides being a character of taxonomic value in its own right, the archeopyle often helps when attempting to determine specimen orientation, girdle and sulcus location, and tabulation. It is especially useful in studying those dinoflagellates with spherical bodies, long processes, and obscure tabulation, called hystrichospheres.

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PALYNOLOGICAL SURVEY OF CERTAIN MESOZOIC-
TERTIARY STRATA IN CALIFORNIA

NSF Grant GP-473 supported a 1-year preliminary palynological study of selected Mesozoic and Tertiary rocks in portions of the Central Valley and Coast Ranges in northern California to determine: (1) where and how palynology can contribute to solving geological problems in the area, and (2) what stratigraphic sequences contain organic microfossils suitable for fundamental paleontological study.

After establishing a laboratory for processing samples, slides from about 800 samples were prepared and examined. These samples were, in part, matrix from specimens in Stanford collections, in part, provided by other agencies and individuals, and, in part, newly collected. Most of the samples are from outcrops. Principal conclusions are:

1. Problems of Franciscan geology are not likely to be solved quickly by use of palynology although contained microfossils permit dating of occasional samples.

2. Two areas of particular promise for future work are: (a) the uppermost Jurassic-Lower Cretaceous sequence north and south of Paskenta west of the Sacramento Valley, and (b) the Upper Cretaceous-lower Tertiary sequence in the belt south of Tracy west of the San Joaquin Valley.

3. Cretaceous-Miocene clastics in the Santa Cruz Mountains generally contain abundant organic matter but only poorly preserved pollen and spores.

4. From lithology or appearance in hand specimens it is not possible to predict with satisfactory consistency how fossiliferous a sample may be or how well preserved its fossils.

5. In many of the better samples dinoflagellates are better preserved and seem to show more striking stratigraphic changes than spores and pollen in the same samples.

As a follow-up of this survey, both taxonomic and stratigraphic studies of dinoflagellates in the areas mentioned in item 2 are now under way. At the same time sampling to delineate additional areas and topics for future research continues.

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RECENT OIL AND GAS EXPLORATION ACTIVITIES
IN WASHINGTON

Exploration activity in Washington has increased during the past 3 years. Thirty-nine drilling permits were issued in 1961-63 compared with 22 permits in the previous 3 years. Exploratory footage drilled in 1962 was 42,463 in 10 wells, and footage in 1963 was 44,757 in 13 wells. Interest is shifting offshore. Six or more major companies conducted marine seismic, gas exploder, gravity, and aeromagnetic surveys during 1963. Approximately 35,000 acres of offshore lands owned by the State of Washington were under lease prior to 1962. Subsequent to 1962, offshore lands under lease increased to an estimated 183,000 acres.

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29D MONARCH AND 10-10 POOL, A "SLEEPER" IN OLD MIDWAY-SUNSET FIELD, KERN COUNTY, CALIFORNIA

The 29D Monarch & 10-10 pool is located 2½ mi. southeast of Taft, California, in the "29D" area of the Midway-Sunset field. Although surrounded by wells in an old producing area, the pool remained undiscovered until December, 1962.

Closure is not present in the uppermost upper Miocene beds on the 29D portion of the Spellacy anticline, but westward thickening of deeper sediments provides localized structural reversal and closure in the Monarch and 10-10 sandstones.

As a result of the pool discovery, seven significant phenomena were noted: (1) long interval tests recovered only strong gas blows in intermingled gas, oil, and water zones; (2) 1,000 feet of productive interval were found in a gross sandstone body having less than 200 feet of structural closure; (3) 10 ft. or less of shale was sufficient to form vertical barriers; (4) a natural boundary within the gross sandstone body separates the Monarch and 10-10 intervals; (5) tilted oil-water interfaces were found in all reservoirs; (6) a 1 ohm-meter increase in resistivity over that of a wet sandstone may indicate clean oil sandstone; (7) comparison of sonic logs before and after testing may show intervals of gas entry in an oil and gas sequence when only gas is recovered.

Cumulative production through March, 1964, exceeds 2,000,000 barrels of 32° API oil and gas equivalents. Daily production approaches 9,000 barrels from 32 flowing wells having an average total depth of 4,700 ft.

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ORIENTED SAMPLING IN CONTINENTAL BORDERLAND

An instrument has been designed which records the orientation of coring devices and other apparatus with respect to magnetic north, and can be used in any depth of water.

Orientation data on Recent marine structures from depths greater than shelf depth have not been obtained in routine fashion in previous studies, thus omitting an important factor of considerable stratigraphic importance. Paleodirectional studies have few modern marine counterparts.

Examples of oriented samples are described from test stations in the San Pedro basin.

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BACKGROUND AND HISTORY OF OUTER CONTINENTAL SHELF MINERAL LEASING PROGRAM

Since hydrocarbons were first discovered near submerged lands, interest has increased in offshore mineral development. President Truman's proclamation of 1945 asserting jurisdiction over the natural resources of the continental shelf of the United States by the Federal Government initiated numerous claims by states and nations as to the control and exploitability of such areas. Also arising from this action were several Supreme Court cases and finally the passage by Congress of the Submerged Lands Act and the Outer Continental Shelf Lands Act allowing leasing and development of the Federal portion to begin in 1954. Further consideration was given by the International Law Commission and the United Nations Conferences on the Law of the Sea regarding possible solutions to unilateral action of nations asserting jurisdiction to large areas of submerged lands including the waters above the subsoil.

Rapid development of the mineral resources of submerged lands during the past 10-15 years has precipitated numerous legal, technical, and associated problems, some of which have been conquered and others of which still challenge the best minds available. It is expected, however, that further accomplishments will allow development in areas previously thought to be incapable of exploitation.

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OFFSHORE EXPLORATION AND DEVELOPMENTS—SOUTHERN SANTA BARBARA COUNTY

The offshore area of southern Santa Barbara County, California, shows every indication of becoming a major oil and gas producing province. This rapidly developing province extends westerly from Rincon Point to Point Conception, a distance of 56.6 statute mi. The total area, within the State 3-mi. limit, currently undergoing exploration and development amounts to 195 sq. mi. A brief discussion of the regional geology and the mode of hydrocarbon accumulation are presented. Approximate statistical estimates are: 223 wells have been drilled to date as exploratory tests or as development wells into objective sandstones; 139 of these were completed as oil producers and 16 were completed as gas-condensate producers; 18.5 million barrels of oil and 70 billion cubic feet of gas have been produced. Speculation on future exploration activities is discussed.

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ORIGIN OF REDBEDS, UNSOLVED PROBLEMS

The currently favored "primary detrital redbed" hypothesis requires modification as a general explanation.

The pigment in some redbeds probably was inherited from red upland soils, but the available data suggest that many redbeds were derived from tan to brown soil and alluvium.

Diagenetic processes played a significant role in (1) converting varied suites of clay minerals in brown alluvium to the dominant illite-chlorite suite in redbeds;