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* (EHRENBERG) 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 *Globoquadrina dutertrei* (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