points on the fault surfaces, defining additional faults, and exchanging points between fault surfaces, *etc.*, until a final interpretation is reached.

The computer performs the tedious tasks of information retrieval, numerical computation, and display generation, whereas the geologist uses his specific knowledge of the problem at hand to evaluate results and propose alternatives until a satisfactory interpretation is reached. The interpretations made in this interactive environment can be geologically and economically superior to those reached by entirely manual or entirely analytic methods.

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CALIFORNIA DIGITAL MAPPING

The Utility Data Corporation, in a joint venture with several petroleum companies, is conducting a precision-mapping program across 50,000 sq mi of the State of California. Accurately located within the project area will be approximately 50,000 section corners and 26,000 historic wells.

The project area has been surveyed by use of high-altitude, high-resolution aerial photography. Within each of the 2,500 photographs, there are photo-identifiable USCGS and USGS monuments that were flagged prior to flight. These are referred to as basic control, and permit, through analytic photogrammetric procedures, positioning of other photo-identifiable points of interest appearing on the photograph to within ± 5 ft of accuracy. These coordinates properly describe, both in latitude-longitude and in the state plane-coordinate system, the location of the point on the geoid.

The program provides a coordinated set of base maps throughout the project area. It provides an accurate area base map with various levels of accuracy in coordinating section and rancho corners; *i.e.*, photo-identifiable (53%), projected/protracted (17%), and calculated (30%). When the positions of the section and rancho corners are refined, significant errors in well locations become apparent.

The end products of the project are a digital file and a graphic file. The digital file contains coordinates of section and rancho corners, historic wells, and other points of interest. The graphic file produces a 15-minute quadrangle, automatically plotted at a scale of 1 in. = 2,000 ft. The equipment currently used for plotting is a Gerber Plotter with optical head to achieve the optimum in edge sharpness.

The California computerized-mapping program is the first of its type and scope to be conducted for the petroleum industry. Implementation of the program acknowledges the impact of the computer upon exploration; further, it reflects the needs of the industry for accurate land-net data, although precision well-location data do not share an equal priority.

The basic program provides an accurate area base map which, if considered as an initial building block, can be used by other elements of a company with minimum costs for supplemental aerial photography in small selected areas. For example, once geodetic control has been established, an overflight at lower altitude provides the Pipeline Department with right-of-way profiles and detail maps, the Production Department with precision plant-inventory records, and the Tax Department with accurate taxing-boundary information. This information is in digital form on tape or cards, formated for introduction into the computer.

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SEDIMENT DISPERSION IN NORTHERN CHANNEL ISLAND PASSAGES, CALIFORNIA

The presence of strong bottom currents in the northern Channel Island passages makes these areas ideal for the study of sediment dispersion and energy regimes by analysis of the textural properties of the sediments.

A grid-sampling system was used to take 25, 36, and 37 grab samples from San Miguel Passage, Santa Cruz Channel, and Anacapa Passage, respectively. The sand fraction of each sample was analyzed texturally by an automatic settling tube. The data then were synthesized by an IBM 360 computer, which constructed 5th-degree trend surface maps for the mean, sorting, skewness, and kurtosis values for each of the passages.

Of the primary agents available for transport of traction load, it is suggested that wind-driven currents are more important in accounting for the sediment distribution than either tidal currents or wave action. Although the last two are active continually, it is believed that their effect is superimposed on the net movement caused by wind-driven currents, and hence they are subordinate processes.

San Miguel Passage is characterized by southeastward sediment dispersion. The energy level is highest in the center of the passage and there is a gradual decrease in energy toward the sides. A lobe of coarse sediment in the northern section of Santa Cruz Channel shows the southeastward dispersion; however, fine sediment from the east moves into the southern part of the area, where it is intercepted by currents at the head of Santa Cruz Canyon. Because there is dispersion both east and west, Santa Cruz Channel may represent a shear zone between two prominent currents. Anacapa Passage shows dominant westerly dispersion with a superimposed north-south tidal-current effect.

All the passages are believed to be at or near equilibrium with respect to sediments and mechanical energy.

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LIMITATIONS OF REFLECTION-SEISMIC METHOD: LESSONS FROM COMPUTER SIMULATIONS

Multiple ground-coverage seismic techniques are based on a few key assumptions. Among the more important are the assumptions that subsurface reflectors locally are continuous and linear, and that the primary reflections between particular source-receiver pairs travel along unique paths. However, overenthusiasm concerning recent advances in the use of "velocity spectra" models has led to some violations of these important assumptions. The most common types of violations involve use of these models in (1) determining primary velocity, (2) computing interval velocities and dips, and (3) migrating depth sections. Although all three processes are industry-wide objectives which commonly are obtainable by other methods, their attainment through the use of the "velocity spectra" models is beyond the limits of current theory. Therefore, those who use "velocity spectra" methods to predict subsurface conditions can be misled by the errors which result.

The theory and limitations of the seismic methods currently employed can be clarified by examining lin-

ear and nonlinear computer-simulation models. Ideal time sections for some of these models illustrate phenomena such as dip reversal, loss of domal character, incomplete unconformity contacts, and creation of faults. Modeling also is becoming increasingly important in reflection-seismic processing and interpretation. However, true progress with models will not take place until we appreciate and understand the limitations of the method, the primary assumptions that are essential, and the consequences of violating these primary assumptions.

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NEW DIMENSIONS: AMPLITUDE AND FREQUENCY MAPPING

(No abstract submitted)

J. LINDSEY, Geo Comp, New Orleans, La.

AUTOMIGRATION OF SEISMIC DATA

(No abstract submitted)

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FOSSIL DIATOMS AND SILICOFLAGELLATES FROM NEWPORT BEACH, CALIFORNIA, STUDIED WITH SCANNING ELECTRON MICROSCOPE

With the advent of the scanning electron microscope (SEM) a new dimension was opened to the micropaleontologist. At its maximum useful magnification of 50,000 diameters, the SEM offers a depth of field of about 10 μ and a resolution of about 200 Å, whereas the optical light microscope, at its maximum useful magnification of 1,300 diameters, offers a depth of field of about 0.5 μ and a resolution of about 2,000 Å. Inasmuch as the classification of diatoms and silicoflagellates is based on the general and detailed characters observed with the light microscope, the use of the SEM must be viewed as an extension of the facilities offered by the light microscope. Ten species of diatoms and silicoflagellates from Miocene rocks, exposed at Newport Beach, California, have been studied with the light microscope and the scanning electron microscope. A comparison of the micrographs of the identical species taken with the two instruments clearly demonstrates the ability of the SEM to provide a more detailed description of taxa, a more precise circumscription of taxa, a separation of closely allied taxa, and a verification of many varieties of taxa.

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OCCURRENCES OF SILICOFLAGELLATES FROM CENTRAL NORTH PACIFIC CORES

Silicoflagellates are siliceous marine planktonic microorganisms which have never been a significant contributor to pelagic sediments. Consequently only limited investigations have been made on these microorganic remains from the deep-sea deposits of the world.

Eleven taxa and one new species of silicoflagellates were recovered from the central North Pacific cores collected above the RV *Thomas G. Thompson* in 1968. The lower lithologic unit of a gravity core, TT28-25, was assigned a Miocene age after careful comparison of previous worldwide records. This is the first time that such a Miocene assemblage has been recognized from mid-latitude North Pacific sediments. From other cores, Quaternary assemblages were noted, including a limited occurrence of *Mesocena* cf. *elliptica*. The most recent extinction of this species seems to coincide with the last appearances of *Dictyocha* cf. *ausonia* and a proposed new species, *D. subarctios*. Their stratigraphic distribution was examined critically in connection with the results of paleomagnetic-reversal records and data on other microfossils from the area.

It is suggested that silicoflagellates could become a useful tool for deep-sea biostratigraphy in the middle latitudes of the North Pacific Ocean.

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BENTHIC FORAMINIFERAL TRENDS IN PACIFIC-ANTARCTIC BASIN

Trawl samples collected in depths from 3,000 to more than 5,000 m allow the following conclusions.

1. The fauna consists mainly of large, widely distributed bathyal and abyssal Foraminifera. Most assemblages are more than 85% arenaceous, but between 3,000 and 4,000 m some assemblages are predominantly calcareous.

2. Species diversity, although variable, reaches a maximum of 37 at nearly 4,300 m. This maximum coincides with a peak in a diversity factor based on information theory; species equitability is highest at a slightly shallower level. Areal diversity trends are absent.

3. Eleven species are dominant both in abundance and consistency of appearance. Of these, only *Uvigerina peregrina disrupta* Todd is calcareous. *Hormosina robusta* (Pearcy) is the most characteristic species in the area. Other important forms are *Haplophragmoides umbilicatus* Pearcy, *Cyclammina pusilla* Brady, and *Recurvoides contortus* Earland. *Cyclammina orbicularis* Brady dominates the shallowest station (3,043 m), and *Reophax nodulosus* Brady is dominant at the deepest station (5,124 m).

4. Latitudinal and longitudinal transects indicate that *Cyclammina pusilla* and *Haplophragmoides umbilicatus* increase in relative abundance toward the south, *Reophax* spp. and *H. umbilicatus* increase toward the east, and *Psammosphaera fusca* Schulze increases toward the west.

5. On the basis of quantitative data available from the western Southern Ocean, a generalized benthic Antarctic foraminiferal zonation seems possible. Bathymetric plots of cumulative percentages of selected index species help in achieving such a zonation.

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PLEISTOCENE-HOLOCENE BOUNDARY IN SOUTHWESTERN INDIAN OCEAN

The Pleistocene-Holocene boundary has been determined in deep-sea cores from the southern Mozambique Channel area of the Indian Ocean. The boundary, dated by radiocarbon at approximately 10,000 years B.P., is defined by changes in the relative abundance of planktonic Foraminifera. These changes reflect a warming in the Holocene of a few degrees Celsius. The temperate species *Globorotalia inflata* (d'Orbigny) shows a marked decrease in relative abundance in the Holocene; it comprises about 20% of the planktonic foraminiferal population below the boundary and only 3% or less above. Simulta-