Upper Devonian sections resulted in establishing a conodont zonation. Altogether 26 conodont zones and subzones have been recognized. The conodont succession was obtained mainly from known ammonoid zones beginning with the uppermost Middle Devonian cephalopod zone of *Maenioceras terebratum* and extending through the entire Upper Devonian into the *Wocklumeria* Stage. To determine the regional constancy of conodont succession, more than 100 Upper Devonian sections from Germany were studied.

The same Upper Devonian conodont succession, recognized in much of Europe, as detailed investigations have subsequently proved. These zones have been found in eastern Germany, Carnic Alps in Austria, Montagne Noire and northern Massif Central in France, Pyrenees and Cantabria in Spain, and Moravia and Bulgaria in southeastern Europe. In addition, in the Belgian Upper Devonian, where the sediments were laid down in a different environment, similar zonal associations and successions coincide with others.

Results of studies in the Upper Devonian outside of Europe (mid-western and northern Africa) support the opinion that conodont succession in the Upper Devonian is the same as that in Europe. Presently known deviations are caused by peculiarities within the local geological sequences (breaks in sedimentation, slow deposition, reworking, redeposition, *etc.*).

A recent study of the ammonoid-bearing Upper Devonian sequence of northwestern Australia carried out by Glenister and Klapper indicates that the European conodont zonation also can be applied effectively in this region.

Conodonts can be used to zone the Upper Devonian in greater detail than the standard cephalopod succession. Recent studies reveal that boundaries between some ammonoid stages are inexactly defined or that there are gaps in the ammonoid succession. By means of conodonts such gaps may be bridged with the result that the best and most complete biostratigraphic subdivision of the Upper Devonian at present is based on conodonts.

PACIFIC SECTION 41ST ANNUAL MEETING, LONG BEACH, CALIFORNIA, MARCH 24–26, 1966

The Pacific Sections of The American Association of Petroleum Geologists, Society of Exploration Geophysicists, and the Society of Economic Paleontologists and Mineralogists will hold their 41st annual meeting at the Municipal Auditorium in Long Beach, California, March 24–26, 1966. Social events will be held in the nearby Lafayette Hotel.

The convention theme is "Offshore Oil," honoring the 70th anniversary of the first offshore oil produced from the old Summerland field, Santa Barbara County, California. The technical program will include more than 50 papers on offshore and onshore exploration and exploitation. The meeting will close with an onshore field trip through the oil fields near Long Beach and an offshore cruise from Long Beach Harbor to Huntington Beach and back on Saturday, March 26.

In addition to an outstanding technical program, activities at the Lafayette Hotel include the joint A.A.P.G.-S.E.G.-S.E.P.M. annual luncheon on Thursday with a speaker from the Department of the Navy discussing the *Sealab II* project. A cocktail party will be held on Thursday afternoon and the S.E.P.M. dinner on Thursday evening. Alumni luncheons will be on Friday and a dinner-dance is planned for Friday evening.

Ladies' activities for both days are being planned and include a tour and shopping in Ports of Call. A hospitality room will be available for the ladies.

More than 50 years ago, on October 2, 1915, a small group of geologists gathered in Tulsa, Oklahoma, for dinner and discussion. This was a time of tremendous expansion of the application of geology to petroleum exploration and the group recognized the great need for discussion and exchange of ideas in the fledgling but rapidly growing science. They adopted as a name the Southwestern Association of Petroleum Geologists. The name of the organization was changed in 1917 to The American Association of Petroleum Geologists and the first *Bulletin* was published. Since that time the Association has become international with members in nearly 80 countries. Total membership is more than 15,000. At present there are 59 local or regional societies affiliated with the Association and Orlo E. Childs of Golden, Colorado, is the national president for the 1965–1966 term.

The geographic distribution of membership throughout the United States led to the establishment of four regional sections: Eastern, Mid-Continent, Rocky Mountain, and Pacific. The oldest of these, the Pacific Section, was organized in 1925 and has more than 1,050 members. The president of the Pacific Section is Eugene R. Orwig, of Mobil Oil Company, who will relinquish his gavel to the new president at the conclusion of the convention.

The objectives of the A.A.P.G. are to advance the science of geology, especially as it relates to exploration, development, and exploitation of petroleum and natural gas, and to foster research and the exchange of ideas. The publication of the monthly *Bulletin* and special volumes, and the Distinguished Lecture Program by outstanding speakers who visit more than 50 affiliated societies and universities each year, implement the achievement of these objectives. The annual conventions, both regional and national, provide occasions for geologists to gather and exchange experiences, ideas, and information in an informal atmosphere of scientific comradeship.

The S.E.G. program will include 15 pages with emphasis on digital recording and processing of offshore exploratory information. Abstracts of these papers have not been included.

ABSTRACTS OF PAPERS

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TAXONOMIC SIGNIFICANCE OF PSEUDOPODIAL DEVELOPMENT IN LIVING PLANKTONIC FORAMINIFERIDA

Axopodial development in the Foraminiferida is of prime importance taxonomically. Classification revisions proposed recently by Bovee and Jahn designate axopodia to separate sarcodines at a subclass level. Yet these are only one of several types of pseudopodia seen in planktonic Foraminifera.

Living Globigerinidae collected off the southern California coast were observed in agnotobiotic cultures for periods up to three months. Healthy globigerinids exhibit a gradual change in the morphology and function of their pseudopodia which is related to the development and secondary calcification of the whole organism. The pseudopodia differ considerably from those of benthonic Foraminifera, except in the bidirectional protoplasmic movement.

Newly formed pseudopodia are short, radiate, anastomosing, and motile, emanating from the sarcode through the test pores. Development of an internal axial core greatly lengthens individual pseudopodia, thereby increasing exposed protoplasmic surface, and providing support for flotation of the organism. The initial axial core is extremely flexible (probably entirely proteinaceous), resulting in tenuous pseudopodia which anastomose distally on contact with one another. Such pseudopodia are readily regenerated following loss by an actively metabolizing young foraminifer.

During development, the pseudopodia increase slightly in width and become brittle as calcification hardens the inner core. At this stage, pseudopodia may be broken by handling, rather than tangled as in young specimens. Anastomosing occurs only in a few specimens by means of slender, temporary connections near the pseudopodial tips. There the protoplasm and granular contents commonly flow undisturbed beyond the tapering end of the solidified core to form an actively motile, retractable probe.

The pseudopodial granular contents range from numerous large, angular particles in new pseudopodia, to relatively few regular and flattened shapes after calcified cores have developed. Calcification increases pseudopodial core diameter while decreasing pore-opening diameter. This restricts the flow of protoplasm along the pseudopodia, and limits the size and shape of transported particles. Finally, as the axial cores become thicker and heavier, globigerinid pseudopodia no longer anastomose. The cores, originating in protoplasm, are trapped by their expansion in the gradually closing pores to form the "spines" referred to in the literature.

The pseudopodia of planktonic Foraminifera thus originate as specialized rhizopodia, which develop into axopodia as growth of the organism proceeds. With such a pseudopodial continuum occurring within one species, classification based on the pseudopodial differences outlined by Bovee and Jahn would cut across specific life cycles. Accordingly, the proposed taxonomy is considered inadequate with regard to the Foraminiferida.

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Injection Water Sources, Wilmington and East Wilmington Oil Fields

Although most of the Wilmington structure lies under or near the Pacific Ocean, water of the quality necessary for waterflooding has to be produced from near-surface deposits.

These deposits may be divided into two parts in the developed Wilmington area: the Gaspur zone, a Recent channel fill of the ancestral Los Angeles River, and the Pleistocene shallow-water deposits down to about 500 feet. These Pleistocene deposits include the "200-foot sand" and the "400-foot gravel" of the San Pedro Formation. All of these sands are salt-water invaded in this area. About 600,000 bbls./day of injection water currently are being produced from 45 wells completed primarily in the Gaspur or "400-foot gravel" zones. Water salinities range from about 1,000 ppm. chloride to approximately that of sea water. Because of the natural filtration of the beds, the oxygen and suspended solids contents are low, but the water has to be treated with bacteriacides prior to injection.

Ditch samples from eight exploratory core holes in the undeveloped East Wilmington field showed the water source beds to be missing in part of the area. Two of the four drilling islands probably will be located where the salt-water-bearing sands are missing. In order to insure an adequate injection-water supply, the islands may have to have an interconnecting water system that ties with additional source wells on Pier "J."

Near the eastern end of the Wilmington structure in the vicinity of the Humble-Texaco Belmont Island, the San Gabriel River flows through the "Alamitos Gap." The shallow river-channel deposits here are neither so deep nor so sharply defined as those of the Los Angeles River. Adequate salt-water-bearing sands are present in the lower San Pedro Formation, which is the equivalent of the Silverado zone on the west.

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Pacific Offshore Drilling and Completion Techniques

(No abstract submitted.)

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Faunal Evidence of Miocene-to-Recent Paleoclimatology in Antarctic

Two independent lines of faunal evidence indicate intermittent if not continuous polar ice in Antarctica from Pliocene or latest Miocene to Recent, an interval of about 11 million years. First, the area of subarctic and Antarctic planktonic Foraminifera extended far into the temperate regions during the Pleistocene; changes of almost equal magnitude are now recorded for the middle Pliocene and the latest Miocene. Second, evaluation of data from deep-sea cores in the southern Indian Ocean and the Antarctic shows dominant Antarctic cold-water radiolarians spanning the interval from latest Miocene to Recent. These data are in agreement with the isotope data by Emiliani that abyssal waters of the Pacific Ocean were reduced to about 2°C. during the Pliocene, as conditioned by low surface temperatures in polar seas. Also, studies in Antarctica by Rutford, Craddock, and Bastien show possible tillites below volcanic rocks that have been dated radiometrically to be approximately latest Miocene or earliest Pliocene.

It is proposed that the upper limit of the Miocene in Antarctic deep-sea cores corresponds approximately

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