for 15 major oil companies over most of this period, while 15 independent oil companies employed an average of 7%. All oil companies together accounted for 75% of the total membership in all areas.

Membership trends in California alone for each year bear a resemblance to exploration activity over the period analyzed. The peak year in California's drilling record for exploratory holes completed and footage drilled corresponds closely with the high point in Pacific Section membership.

Membership figures used in this analysis consist of the total number of active and subscriber members. Only paid members could be counted inasmuch as all available lists include only this group. A check was made against the geographical roster of the national A.A.P.G. March *Bulletin* for each year to find the relation between national and Pacific Section members.

CHARLES C. BATES, Advanced Research Projects Agency

Vela Uniform—Nation's Quest for Better Detection of Underground Nuclear Explosions

Negotiations between the USSR, United Kingdom, and the United States have been in progress since 1958 in an effort to achieve a treaty for cessation of nuclear weapons testing under an effective control system. To support these negotiations, the President announced in May, 1960, a major expansion of the present research and development program, VELA UNIFORM, directed by the Advanced Research Projects Agency. The program's goal is to provide a markedly improved capability in detecting and identifying underground nuclear explosions during the coming two years. Starting as a $10,000,000 effort in the fiscal year just past, spending during the present year is at the rate of about $66,000,000, making the project the largest terrestrial science effort underway within the U. S. at the present time.

The Advanced Research Projects Agency, with the technical assistance of the Air Force's Technical Applications Center, is employing several approaches for rapidly improving the state of the art in subsurface nuclear test detection. These include a several-fold expansion of the effort going into basic seismological research; procurement of instruments for a world-wide seismic research program; development of improved seismic instruments; construction and operation of prototype seismic detection stations; and an experimental program of underground explosions encompassing both high explosive and, where necessary, nuclear explosions. Already in the program are such government agencies as the Department of Defense, Atomic Energy Commission, Department of Commerce, and Department of Interior, as well as universities and private organizations, both profit and non-profit. Provision has been made for investigation of all aspects of improvement considered feasible. To this end, unsolicited proposals bearing on such improvement from both profit and non-profit organizations, domestic and foreign, are invited. Outstanding unsolved problems include development of a better global knowledge of the layering of the earth's crust, a need for improved instrumentation and data analysis capable of markedly improving signal-to-noise relationships, improvement of techniques for distinguishing at great distances the differences between earthquake and explosion-induced seismic signals, and the providing of on-site inspection techniques that are much more rapid and economical than those existing today.

CHARLES B. OFFICER, Marine Geophysical Services Corporation

Petroleum Exploration with Gas Exploder and Sparker Offshore California

Petroleum exploration with the Gas Exploder and Sparker has been conducted over a number of offshore and inland water-covered areas of interest throughout the world. One of these areas which has received considerable attention has been offshore California.

A description of both the Gas Exploder and Sparker equipments and methods of operation is given; illustrative records of each are shown and discussed. The results are presented in the form of a geologic cross section. The structural configuration is shown in detail. In general offshore California, both the configuration of anticlines and the strike and dip of fault planes can be mapped.

The Gas Exploder obtains continuous reflections down to depths of 3,000–4,000 ft. The seismic source for the Gas Exploder is the underwater explosion of a mixture of propane and oxygen in an open cylinder.

The Sparker obtains continuous reflections down to depths of 600–800 ft. The sound source for the Sparker is the underwater detonation of a 10,000-volt spark discharge. The Sparker shows more detail of the structural configuration down to 600–800 ft. than the Gas Exploder.

Both the Gas Exploder and the Sparker can be operated at the same time on the same survey. Several of the more recent surveys have been conducted in this manner.

CARL H. SAVIT, Western Geophysical Company of America

Solving the Singing Record

Extensive theoretical study and experimentation reveal that theoretical models do not approximate actual singing situations to better than the first order. Measurements of singing amplitudes, however, indicate that, in many cases, attenuation of singing must be of the order of 40 db in order to produce a useful record. Based on these observations, a system was designed using cascaded frequency-domain filters and empirically determined parameters to remove the singing-complex from tape-recorded data. Application of this system to singing records from various areas of both the eastern and western hemispheres has been spectacularly successful.

WENDELL H. RUSSELL, Baroid Division, National Lead Company

Quantitative Mud Analysis for Hydrocarbons

Prior to recent developments, results obtained by mud-analysis logging have been qualitative not quantitative. The magnitude of gas shows obtained was not necessarily an accurate reflection of the concentration of gas entrained in the drilling mud. Nor could one safely assume that similar concentrations of gas in different mud samples would yield readings of similar magnitude.

The analytical method employed in determining the type and concentration of hydrocarbon gases in the drilling mud was the weak point in early mud logging. The gas chromatograph, incorporated in present equipment, has overcome the analytical problem. The remaining obstacle to precise mud analysis has been that of extracting all the hydrocarbon gases from the drilling mud for analysis. With the development of equipment

capable of extracting substantially all of the gases from a mud sample, regardless of the drilling mud properties, it is now possible to obtain reproducible, quantitative mud analyses. Such analyses are essential if the full value of mud logging is to be realized.

ROBERT L. MANLY, Standard Oil Company of California

Graphical Analog Dip Computer

An especially calibrated stereographic net is described and displayed which is the foundation for the computer assembly. A transparent overlay disc printed with suitable reference marks and a central fastener pin complete the computer. Input and temporary data storage are accomplished by using a sharpened grease pencil to plot data on the transparent disc.

Two apparent dips relative to the bore axis-normal produce a pole plot of the uncorrected dip. Tool orientation, inclination and drift corrections are made by following a simple three-step technique on the overlay. Readout of true dip and direction of dip corrected for magnetic declination is automatic. The operation from raw data to finished results requires less than one minute.

Dips up to 89°, with or without hole drift angles up to 89°, can be accurately handled. Overturned bedding relative to the bore is readily indicated.

ROBERT A. HARMAN, University of Southern California, Los Angeles

Foraminiferal Variation in Sediment Layers of Santa Barbara Basin, California

Quantitative variations in foraminiferal assemblages characterize the three different sediment types found in cores from the Santa Barbara basin. Gray turbidity sediments contain low foraminiferal numbers and usually a high percentage of benthonic Foraminifera. Laminated sediments are typified by very few specimens of *Bolivina argentea* and by variable foraminiferal numbers. Homogeneous sediment layers also have highly variable foraminiferal numbers, but contain a diverse fauna and a large number of *Bolivina argentea*.

No arenaceous and very few porcellaneous foraminifera are present in the basin. The number of benthonic specimens present appears to be directly proportional to the number of planktonic specimens present.

The frequency at which Foraminifera are added to the sediment was determined by using rates of sediment deposition. Solution effects on Foraminifera were especially noted in the upper 100 cm. of the cores studied.

JOHANNA RESIG, Allan Hancock Foundation, University of Southern California

Ontogenetic Variation in Eponides Repandus (Fichtel and Moll)

HELEN TAPPAN, University of California at Los Angeles and U. S. Geological Survey

Foraminifera from Pleistocene Gubik Formation of Northern Alaska

About 70 species of Foraminifera have been obtained from wells and seismic shotholes of Naval Petroleum Reserve 4. The majority of the species are now living off the coast of Alaska, and in the Arctic seas. Approximately one third of the species are Miliolidae, the remainder mostly Polymorphinidae, Nonionidae, and Elphidiidae, with a smaller number of Nodosariidae, Cassidulinidae, and a few rotaliform genera.

The complete absence of planktonic species, in contrast to Recent Pleistocene faunas of southern Alaska, is probably due to the local shallow water conditions during the Pleistocene.

M. A. FURRER, California Research Corporation

California Cretaceous "Siphogenerinoides"

Recorded occurrences of California Cretaceous *Siphogenerinoides* are restudied on the basis of topotype collections and comparisons are made with those from the Gulf Coast Texas Cretaceous sediments. Based on comparisons with the type species of *Siphogenerinoides*, *S. plummeri* (Cushman), it is suggested that California Cretaceous "*Siphogenerinoides*" be allocated to other categories.

DONALD HOWARD DAILEY, Richfield Oil Corporation

Stratigraphic Paleontology of Jalama Formation, Western Santa Ynez Mountains, Santa Barbara County, California

The Jalama formation of Late Cretaceous age is exposed along both sides of the Pacifico fault in Jalama and Santa Anita canyons in the Western Santa Ynez Mountains. It consists of 2275± feet of alternating sandstones and silty shales that have been divided into seven members. The base is nowhere exposed but the geologically older Espada formation in Salsipuedes Canyon is Late Jurassic in age, which suggests an unconformity at the Espada-Jalama contact. The relationship between the Jalama and overlying Anita formations is uncertain at the type locality but an unconformity exists beyond this area.

Approximately 133 species of Foraminifera, of which the majority are calcareous perforate forms, have been identified from nineteen localities. Three separate foraminifer faunules of characteristic composition can be distinguished. Forty-four localities have yielded 58 molluscan species that have been treated systematically; 12 pelecypod species and 5 gastropod species are new. The megafauna can not be broken down into stratigraphic faunules but may be subdivided into 2 ecologic groups.

Both the foraminifer and molluscan assemblages indicate a late Campanian age for the Jalama formation. The Foraminifera correlate with Goudkoff's Tracian and upper Weldonian stages and with the lower Navarro of the Gulf Coast.

The megafauna is most closely related to the molluscan assemblage of the upper Chico formation, but is slightly younger, and is very close in age to the Cretaceous sediments in Bee Canyon, Orange County, California, in the Sucia Islands, Washington, and in the lower horizon in the Simi Hills, Ventura County, California.

DON L. PROTZMAN, East Los Angeles College

Facies Relationships of Sespe and Alegria Formations, Santa Barbara County, California

The stratigraphic relation between the Sespe and Alegria formations consist of a gradual facies change from the terrestrial environment of the Sespe to the marine environment of the Alegria. Detailed columnar sections show the gross lithologic members within the two formations. Individual members lose their identity laterally over the relatively short distance of approximately a mile or less, with changes in lithology, texture and color, or a combination of these, and exhibit much