W. H. BERGER—How *Globigerina* ooze is formed
O. B. BOURN—An application of Upper Pennsylvanian palynological data to determine environments of deposition
P. W. BRETSKY—Upper Ordovician bryozoan diversity as function of sedimentation rates
J. CHRONIC—Variability of fusulines from type locality of *Fusulina rockymontana*
D. J. COLQUHOUN—Faunal isolation near primary strandlines
J. T. CUTBILL—Economic, technical, and theoretical obstacles to construction of adequate classification of fusulinid Foraminifera
R. A. DAVIS, JR.—"Canadian-Ozarkian" unconformity in upper Mississippi Valley
M. A. DIXON—Fish otolith assemblage of a gastrolithic beach gravel
R. C. DOUGLASS—Studies of variation in fusulinids based on *Monodiexodina*
F. ELBAZ—Coprolites *versus* fecal pellets
J. A. EVER—Ontogeny and phylogeny of Charophyta
W. T. FOX—Computer simulation of influence of environment on populations through time
T. FREEMAN—Operational classification of unconformities
F. E. KOTTLOWSKI—Influence of Pedernal uplift on late Paleozoic sedimentation
H. R. LANE—Symmetry in conodont element-pairs
H. LING—Radiolaria from northeast Pacific surface sediments
S. MCCOY, JR.—Paleoecology and paleontology of Wann Formation, northeastern Oklahoma
D. A. MYERS—Stratigraphic distribution, Pennsylvanian fusulinids, Manzano Mountains, New Mexico
M. NESTEL—Systematics and distribution of fusulinid genus *Afghanella*
W. T. ROTHWELL, JR.—Mirror-image of climate-caused foram extinctions: Pacific and Gulf Coast
G. A. SANDERSON—Morphologic variability of species *Schwagerina complexa* and its stratigraphic implications
C. H. STEVENS—Water-depth control of fusulinid distribution
D. C. SWANSON, R. R. WEST—Anomalous Morrowan-Chesterian correlations in western Anadarko basin
D. E. WADDELL—Fusulinid mensuration—forward or backward?
K. R. WALKER—Biogenic sedimentary structures in facies of Middle Ordovician Black River Group of New York State
L. R. WILSON—Stratigraphy and palynological succession of Pennsylvanian coal seams in Oklahoma
D. ZIGIC-TOSHICH, L. I. BRIGGS—Facies structure based on functional classification of stratigraphic components

A.A.P.G.-S.E.P.M. ANNUAL MEETING

Oklahoma City, Oklahoma, April 22–25, 1968

ANNOUNCEMENT TO MEMBERS OUTSIDE UNITED STATES

AAPG-SEPM members residing outside the U.S.A. and Canada, who are planning to attend the Annual Convention in Oklahoma City, Oklahoma, April 22–25, 1968, may request the Convention Announcement and Official Housing Application form to be sent them by airmail by notifying AAPG headquarters in advance. Such requests should be addressed to: AAPG Convention Department, P.O. Box 979, Tulsa, Oklahoma 74101, U.S.A.

Announcements and housing forms thus requested will be airmailed in December. The general mailing on January 19 will be by ordinary surface mail and may not allow enough time for members residing outside the U.S.A. and Canada to be assured of accommodations of their choice.

The Preliminary List of Papers to be given at this 53rd Annual Convention precedes this announcement. The general theme of the Convention is "Geology of the Giants," featuring a comprehensive look at the giant oil and gas fields of the world and their relationship to modern exploration programs.

JOHN C. MEYER, JR., *Chairman*
Hotels and Housing Committee

DISTINGUISHED LECTURE TOUR ABSTRACTS, 1967–1968

DONN S. GORSLINE, Univ. Southern California, Los Angeles, Calif.

SEDIMENTARY PROCESSES AND THEIR ROLES IN FORMATION OF FUTURE SOURCE AND RESERVOIR ROCKS

In order to understand more fully the principles of transportation in shallow parts of all marine systems, a series of studies by diving geologists at the University of Southern California are aimed at providing new data on the mechanisms of sediment movement from the surf zone to depths of approximately 100 ft. It is evident from the first results of this program that much of the theoretical information on wave transport based on wave-tank observations must be modified.

Measurements have been made of rates of sand movement using dyed sand (Vernon, 1965), magnitude of wave-generated surges over the bottom in shallow depths (Vernon *et al.*, 1966), changes in energy in the surf zone (Ingle, 1966; Schiffman, 1965), regional changes in beach characteristics (Gorsline, 1966), movement and quantity of suspended sediment over the shelf (Rodolfo, 1964; Wildharber, 1966), and movement of fine sediment in canyons (Gorsline, in progress). These various measurements show that the wave transport of sediments is active to depths of 60–80 ft off California during an average year and that the flow of sand along the coast probably is matched in magnitude by the flow of fine suspended material. It is also demonstrated that sand moves around headlands below surf depth and is then moved back into the surf system by onshore wave action. Much of the sand entering submarine canyon heads probably is moved in below surf depth by this same ripple-transport mechanism.

All of these systems are strongly controlled by bottom or coastal physiography. In addition to the commonly considered physiographic barriers to sedimenta-

tion, numerous contemporary examples of water barriers also exist that have effects at all scales on the distribution and character of marine sediments. Because these are also the precursors of most source and reservoir rocks, an understanding of their effects is of basic importance to petroleum geologists.

On a relatively small scale, circulation patterns in Florida Bay, at the southern tip of the Florida peninsula, are slow tidally controlled gyres which create a flow that probably prohibits sediment transport into the central portions of the individual "lakes" of this broad shallow embayment. Thus the sediment accumulation occurs around the periphery of the individual segments and these lines of sedimentation in turn appear to coincide with the locus of points of small or zero tidal amplitude. Current transport of these materials also takes place and thus they ultimately come to rest in the deep water of the Florida Straits.

In large coastal bays on the Pacific coast, water circulation also plays a strong part in the distribution of sediment types. Sebastián Viscaíno Bay is an open, broad, north-facing embayment that also forms the southern extremity of the continental borderland off California and Baja California. Within this huge embayment the California Current turns back on itself and forms a large gyre. The patterns of texture, bioclastics, and organic content are strongly controlled by this circulation pattern and, in fact, parallel the contours of flow.

Work by K. S. Rodolfo at U.S.C. shows that the shift in the monsoon and the period of strong river flow combine in the Andaman Sea to restrict Irrawaddy sedimentation to the confines of the sea even though no physiographic barrier is present to hinder flow to the adjacent Bay of Bengal. Thus, the sedimentation in the two areas is from two different sources producing lenses of sedimentation of geosynclinal scale side by side from different sources. The development of the entire Andaman margin is effectively controlled by these circumstances.

Off the southern Atlantic coast of the United States, the Gulf Stream forms an effective boundary to the detrital terrigenous sediments of the upper shelf and the bioclastic sediments of the outer shelf and Blake Plateau. The combination of broad shelf and strong regional current also influences the form of the coast and apparently also prevents the active formation of submarine canyons.

HAROLD MASURSKY

LUNAR STRATIGRAPHY AND SEDIMENTATION

(Abstract to be published in November issue of *Bulletin.*)

JAMES R. McNITT, California Div. Mines and Geology, San Francisco, Calif.

STATUS OF GEOTHERMAL RESOURCES DEVELOPMENT

The total installed capacity of geothermal generating plants in the world today is approximately 620 MW, distributed among the following five countries: Italy, 340; New Zealand, 190; USA, 50; USSR, 30; and Japan, 10. Although exceedingly small in comparison with the world's total generating capacity from conventional sources, the rapid growth of this new industry is reflected by the fact that more than half of this present geothermal capacity has been installed during the last 10 years. The success of these installations is stimulating worldwide interest in geothermal energy, and exploration projects are now underway in Mexico, El Salvador, Chile, Turkey, Kenya, China (Taiwan), and the Philippines.

The principal incentives for development of geothermal power are: (a) the lack of more conventional sources in the market area, and (b) the competitive economic position of geothermal power even in those areas where other sources are available. Geothermal sources generate low-cost power even at capacities under 100 MW, making them particularly advantageous in market areas where power demands are still low. Low steam pressures make it necessary to use small generating units, *i.e.*, on the order of 25 MW, but total capacities of several hundred megawatts can be expected from a single steam field.

All the thermal areas now under investigation share a common regional geologic setting: the areas are located in orogenic zones, where late Tertiary or Quaternary volcanism has taken place. The thermal areas, however, are not necessarily in close proximity to volcanic centers. Tectonically the regions are characterized by vertical movements, both uplift and subsidence, which have taken place on normal faults. Fault blocks, tilted consistently in one direction, appear to be more common than horst and graben structures.

Variations in local structure, stratigraphy, and hydrology result in considerable differences in the geologic characteristics of individual steam fields. Fault zones, permeable strata, or a combination of both, can form thermal fluid reservoirs. Although it is now generally agreed that the heat sources are shallow intrusive bodies and the thermal fluid is at least 95% meteoric in origin, there are still many fundamental problems as yet only partly answered. How is the heat transfer actually accomplished? Do phase changes occur in the thermal fluid under natural conditions or only when the system is under exploitation? What are the roles of convection currents and caprocks in forming an economically exploitable deposit? What factors determine the life expectancy of the field?

Geothermal exploration methods have not advanced far beyond the stage of merely drilling on hot springs, except in Italy where geothermal gradient surveys have been applied successfully. Recent results from deep resistivity surveys, however, indicate that this method holds considerable promise. Much progress has been made in understanding the chemistry of thermal systems and in the near future this knowledge should form the basis of effective exploration methods.

Although the successful development of geothermal resources offers a great challenge to exploration geologists and engineers, it offers no less a challenge to power legislators, planners, and administrators. Because natural steam must be utilized when and where it is produced, successful development requires the closest cooperation between the exploration groups and the power marketing and distribution sector. Rapid development of geothermal power cannot be expected until these two groups, and the legislators who control their activities, arrive at a mutual understanding of each others' problems.

FRANCIS G. STEHLI, Western Reserve Univ., Cleveland, Ohio

PALEOECOLOGICAL RECONSTRUCTION OF DEPOSITIONAL ENVIRONMENTS—SOME TECHNIQUES OF POSSIBLE EXPLORATION INTEREST

Organisms are extremely sensitive to many parameters of the physical environment and their fossil remains may thus be used in the interpretation of an-