5. G. deV. Klein: Directional relationships between primary structures and current systems in a tide-dominated environment 3:00
6. U. Von Rad, R. Hesse: Possible non-turbidite origin of deep-sea sands in Cretaceous flysch (Bavarian Alps, Germany) and Recent San Diego trough (California) 3:15
7. C. T. Fray: Relations among shear strength, physical, and acoustical properties of sediment cores from eastern Pacific 3:30
8. R. H. Dott, Jr.: Cohesion and flow phenomena in clastic intrusions 3:45
9. L. G. Henbest: Date of silicification and relative strengths of biogenic calcite in plastically deformed Permian limestone, Ubehebe Peak area, California 4:00
10. E. F. McBride: Textures and structures in Catahoula (Gueydan) Tuff, south-central Texas 4:15
11. Pei-Jen Lee, G. C. Winder: Fabric of a Middle Ordovician limestone at Colborne, Ontario 4:30
12. A. E. Weidie, C. P. Cameron, J. J. Long, Jr., E. J. Ritchie: Petrographic and chemical study of Yucatán carbonates 4:45
13. W. R. Bryant, J. L. Harding: Geotechnical properties of marine sediments from Gulf of Mexico (Read by title)
14. G. M. Friedman: Porosity changes during lithification from unconsolidated carbonate sediment to consolidated limestone (Read by title)

THURSDAY AFTERNOON, APRIL 28

S.E.P.M.—Paleontology and Stratigraphy—General Session

Presiding: Ralph Langenheim, Don Hattin

1. K. M. Towe, R. Cifelli: Aspects of wall ultrastructures in some hyaline Foraminifera 1:30
2. L. B. Gibson: Foraminiferal species diversity distributions, eastern Gulf of Mexico 1:50
3. G. A. Fowler: Foraminiferal paleoecology of upper Miocene Montesano Formation, western Washington 2:10
4. R. F. Lundin: Ostracodes and Siluro-Devonian boundary in south-central Oklahoma 2:30
5. R. A. Davis, Jr.: Early Ordovician algal stromatolites in upper Mississippi Valley 2:50
6. J. D. Howard: Nearshore depositional environments of Upper Cretaceous Panther Tongue, east-central Utah 3:10
7. H. H. Gray, G. D. Brown, Jr., J. A. Lineback: Physical techniques of correlation applied to Upper Ordovician rocks of southeastern Indiana 3:30
8. E. A. Pessagno, Jr.: Eaglefordian (Cenomanian-Turonian) stratigraphy in Mexico and Texas 3:50

ABSTRACTS OF A.A.P.G.-S.E.P.M. PAPERS

St. Louis, Missouri, April 25-28, 1966

ADSHEAD, PATRICIA C., University of Southern California, Los Angeles, California

Observations on Living Planktonic Foraminifera in Cultures

Planktonic Foraminifera collected in coastal waters off southern California were maintained in agnotobiotic cultures for periods up to 3 months. Culture techniques developed in this laboratory sufficed to ensure the survival of healthy, floating specimens of young *Globigerina bulloides* d'Orbigny and other plankton for extended observation and photography after collection.

A standard routine was used at each collecting station. More than 1 gallon of sea water was pumped from a depth of 3 m. and the temperature recorded. Vertical plankton tows were made with coarse- (253-micron) and fine- (61-micron) mesh nets, using a slow return speed of about 5 m. per minute. The samples were diluted immediately in sea water and picked rapidly for Foraminifera and mixed planktonic algae onboard ship. The resulting specimens were placed in filtered sea water (five foraminifers per 4.5-ounce jar), packed in a basin with damp paper towels, sealed, and returned to the laboratory. There they were fed from established algal cultures, covered, refrigerated in constant light at 15°C., and changed the next day into filtered *in situ* sea water containing mixed algae.

Cultures were limited to five or less specimens per 6-ounce dish, and were changed regularly. Squares of plastic film were used to cover cultures, in order to retain moisture and relatively constant water conditions. The Foraminifera were fed mixed planktonic algae from cultures started at each station and subcultured into filtered *in situ* sea water.

Because *G. bulloides* was the most common species encountered in tows, it was predominant in the cultures. Young transparent specimens gave the best results. They commonly developed tenuous, elongate pseudopodia, measuring up to 10 times the test diameter in length, which supported the specimens in flotation for periods up to 3 months. Some specimens in culture developed into orbuline stages previously identified in the literature as *Orbulina universa* d'Orbigny. Other orbuline stages were collected in the tows. Most lived approximately 3 weeks, during which time they passed through a series of developmental stages. Changes in the morphology of the globigerinids and their orbuline phases were photographed.

Bright orange-yellow zooxanthellae were present in most of the plankton studied. They were most obvious in newly formed orbuline phases, as well as in healthy globigerinids, and appeared to be related in numbers to metabolic activity of the host organism.

Several radiolarian species from different families also were maintained floating for more than a month, and preliminary observations were made on their structures.

ALLENBY, RICHARD J., Manned Space Science Division, National Aeronautics and Space Administration, Washington, D.C.

N.A.S.A. Lunar and Earth-Orbital Programs of Special Interest to Exploration Geologists and Geophysicists

(No abstract submitted.)

ANDERSON, RICHARD E., Canadian Stratigraphic Service Ltd., Calgary, Alberta

The Computer and the Subsurface Geologist

Much has been written pertaining to the geologist and the computer. Most research divisions in oil companies, universities, and governmental agencies are working on methods and techniques which will make it practical for the geologist to use the computer. The fact still remains, however, that only a very small percentage of subsurface geologists are using computers as a means of retrieval of data.

Management and geologic departments probably are equally at fault for the slow development in the use of the computer by geologists. The geologist, because of his lack of knowledge of how the computer will be of direct value to the exploration department, hesitates to approach management for the personnel and equipment that would be required. Management, because it is not being pressured, is willing to let the geology department function without the computer. Management should be providing trained computer personnel to the exploration departments.

Sufficient experimental, as well as practical, work has now been carried out so that there is no longer any doubt that the computer is a necessity in nearly all exploration departments. Companies which do not become computer-oriented will find it more difficult to compete, especially with the new techniques being adopted and the ever-increasing volume of data.

Methods of data acquisition and storage vary and can become complicated, depending on the volume of data stored. The geologist will not have to concern himself with how the data are stored, but will need to have a complete knowledge as to what data are stored. The programming to retrieve data also can become highly technical; however, the geologist should concern himself more with how he will use the data than how he will retrieve it.

The geologist relies on a variety of sources for his basic information. Probably the most fundamental and important source is from the stratigraphic section. Time needed for preparing and digesting large quantities of stratigraphic data always has been a major problem for the exploration departments. A service has been in operation in Canada since January, 1964, which provides the industry with detailed processed stratigraphic data on punch cards. An outline is presented on the type of data processed, method of processing, and some of the practical applications.

AUSTIN, RONALD L., University of Southampton, England, DRUCE, EDRIC C., Bureau of Mineral Resources, Canberra, Australia, and RHODES, FRANK H. T., Ohio State University, Columbus, and University of Wales

British Lower Carboniferous Conodont Faunas and Their Value in Correlation

Six hundred samples of limestone and shale from the Lower Carboniferous of southwestern England and Wales and central Scotland were processed for conodonts. The samples yielded over 25,000 identifiable specimens, referable to 170 species, representing 26 genera. Two genera, 22 species, and 12 subspecies are new.

The faunas have been divided into a succession of 16 conodont assemblage zones, which are used as a basis for correlation between standard sections in various Carboniferous provinces of Great Britain. They also make possible correlation with the successions in Germany and North America, to which faunas there is a strong general similarity. Local differences are attributed to sedimentary breaks, limited geographic distribution, and conodont phylogeny.

In the southwestern province of Britain, the greater part of the K zone is correlated with the Cu-I goniatite zone of Germany; the uppermost K, Z, and C zones with the Cu-II zone; and the C_2S_1, S_2, D_1, D_2, and lower D_3 zones with the Cu-III zone. The upper D_3 zone is of E_1 (Namurian) age.

The upper part of the Calciferous Sandstone Series of the Midland Valley of Scotland is of Cu-III α age, the Lower Limestone Group of Cu-III β/γ age, and the Upper Limestone Group of E_1/E_2 (Namurian) age.

BANDY, ORVILLE L., University of Southern California, Los Angeles, California

Base of Pleistocene in Los Angeles Basin, California

Populations of *Globigerina pachyderma* (Ehrenberg) are consistently left-coiling, cool-water types in sections of the lower Pleistocene of the Los Angeles basin, California; right-coiling, warm-water populatons are predominant in the upper Pliocene. The base of the Pleistocene, defined in this way, indicates a major change in water masses of the southern California area at that time. Recent radiometric dates by Obradovich place this boundary about 3 m.y. ago.

Populations of *Globigerina pachyderma* reflect bathyal conditions generally; modern populations in