In recent years many writers have presented various measures dealing with the relative concentration or variety of species in biologic communities. The results of these studies suggest a high degree of order in community structure. This order is expressed by a regular arrangement of population elements into a definite hierarchal pattern characterized by dominants in association with a progressively diminishing number of subsidiary species. In populations of high diversity, differences between the numerical census of dominant and subsidiary species is low. Low-diversity populations have low variety, and census differences between dominants and subsidiaries are great. Various explanations have been proposed to account for these differences as well as the order in biotic communities. The responsible agents have been most frequently characterized as being the results of adjustments caused by intra- and interspecific competition, successional development, and trophic relationships. The writer believes that these processes are important ultimately only when the ecologically defining factors within the environment are limited to little variation.

Foraminiferal diversity distributions in the eastern Gulf of Mexico are offered to support the contention that population complexity is primarily a function of variability in environmental conditions. Maximum diversity is confined to the continental slopes, and isodiversity contours from the edge of the shelf seaward follow bathymetric contours. Isodiversities on the continental shelf are variable and register bottom topography and the net effect of prevailing current and wave forces.

Statistical error plotted for the calculated species diversities is below 10 per cent. Because population variety is limited by the degree of variability in the mechanical and non-mechanical ecologic factors characterizing the environment, diversity plotted in relation to depth alone shows no correlation.

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EARLY DIAGENESIS AND MASS PROPERTIES OF SILICEOUS OOZES

Three piston cores, 22–26 m. long were taken in a relatively undisturbed condition during 1964 in the southern Pacific Ocean in about 5,200 meters of water by the U.S.N.S. *Eltanin*. All were of approximately the same siliceous-ooze lithology. Shear-strength (cohesion) measurements were made at those depths in all of the cores where samples were taken for measurement of water content, texture, mineralogy, and geochemistry. Similar measurements were made on a 6-m. core of calcareous ooze from 4,000 m. of water for comparison. Statistical analysis of 13 variables of the grouped data from the long cores shows that 41.60 per cent of the variation in cohesion is accounted for by the following, in order of their relative importance as ranked in multiple regression: depth in core (20.88%), $CaCO_3$ content (9.0%), silt content (3.07%), water content (5.16%), sand content (1.62%), and sorting (1.87%). In the calcareous ooze, core cohesion varies only as depth (63.91%) and the ratio chlorite: illite (24.19%). All cores show a decrease in water content and an increase in cohesion with depth. The siliceous ooze shows a progressive degeneration in its matted texture with depth, which is attributed to the solution of opaline tests and an attendant growth of the following authigenic minerals, as identified by X-ray diffraction: K-feldspar (microcline, orthoclase, and anorthoclase); Na-feldspar (albite and oligoclase); quartz; amphibole; phillipsite; clinoptilolite; dahlite (?); and wilkeite(?) and montmorillonite.

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LOCAL AND INTERREGIONAL DISTRIBUTION OF LATE PALEOZOIC CEPHALOPODS

Despite the ability of cephalopods to move freely through the sea, their geographic distribution patterns tend to be restricted. Many genera but few species were widely distributed in the past. In fact, it is by means of distribution patterns at the generic level that most interregional correlations based on cephalopods are made.

Carboniferous ammonoids common to strata on both sides of the Atlantic Ocean in the Northern Hemisphere include: *Protocanites lyoni* (Meek and Worthen) in the late Kinderhookian and late Tournaisian; *Goniatites crenistria* Phillips in the late Meramecan and late Viséan; *G. granosus* Portlock and *Neoglyphioceras subcirculare* (Miller) in the early Chesterian and late Viséan; *Eumorphoceras bisulcatum* Girty, *Anthracoceras paucilobum* (Phillips), and *Delepinoceras bressoni* Ruzhentsev in the late Chesterian and early Namurian; *Branneroceras branneri* (Smith) in the Morrowan, middle Namurian, and Bashkirian; and *Politoceras politum* (Shumard) in the Desmoinesian and Westphalian C. These few species constitute the principal "pegs" on which the correlation framework is hung. Apparent lack of species common to both sides of the Atlantic in Late Pennsylvanian and Permian deposits may result from more complicated sutures, which make differentiation in these ammonoids easier to establish.

Nautiloids generally tend to have greater stratigraphic ranges than ammonoids, but some were just as restricted stratigraphically and equally distributed geographically as some ammonoids. A few coleoids also had moderately extensive geographic ranges.

Factors that probably influenced cephalopod distribution include swimming and feeding habits, reproduction, buoyancy, sea-water properties (pH, salinity, other chemical features of the sea water, and prevailing currents), physical barriers, and type of bottom.

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PHYSICAL TECHNIQUES OF CORRELATION APPLIED TO UPPER ORDOVICIAN ROCKS OF SOUTHEASTERN INDIANA[1]

For more than 60 years, formations of Late Ordovician age in southeastern Indiana have been identified on the basis of the contained fossils. Unpredictable variability of the rocks has been given as the reason that lithologic criteria were not used. It is true that individual beds are not persistent laterally, but groups of beds can be traced by using electric and other geophysical logs, quantitative insoluble-residue logs, and

[1] Published with permission of the State Geologist, Indiana Geological Survey.

lithologic-summary logs compiled from detailed measured sections. These techniques have the common advantage of objective automatic generalization, so that meaningless details are minimized and important lithologic trends can be seen. Many of the systematic variations in rock content thus revealed can be traced with confidence across the outcrop and into the subsurface.

Shale comprises about 80 per cent of this 900-foot-thick body of rocks; limestone of several distinctive types makes up the remainder. Formations recognized include, in ascending order, the Lexington Limestone of recent Kentucky usage and the Kope, Dillsboro, Saluda, and Whitewater Formations. The recently defined Tanners Creek Formation can not be distinguished on a strictly lithologic basis, and it is therefore included in the Dillsboro. The Lexington and the Saluda are dominantly carbonate units; the Dillsboro and Whitewater are principally shale but include significant quantities of limestone; and the Kope is almost entirely shale. The boundaries of these formations can be rather closely identified on the several types of logs mentioned above, and refinements usually are possible where original detailed data are available. Intermediate beds and horizons also can be identified and traced for considerable distances.

In dealing with apparently disorganized rock sequences of this type, it is essential to utilize or devise techniques to elicit generalizations from the confusing maze of data.

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Space Program Applications of Techniques, Methods, and Instrumentation Utilized in Petroleum Exploration

(No abstract submitted.)

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Geology—For Human Needs

There is no factor vital to the human race into which geology does not explore or participate in some manner, however remote, and, whether the public is aware of it or not, it is true that our science of geology is among the most important in the future welfare of the world's peoples. Based on this premise, the writer briefly reviews the history of the science of geology, cites examples of items of human needs attributable to geology, and discusses why the science of geology is being called on now, more than ever before, to meet new challenges to participate in projects to help meet the ever-growing needs of mankind.

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Nomenclature of Carbonate Rocks

For three years the Carbonate Rock Subcommittee of the A.A.P.G. Research Committee has been compiling data for approximately 500 terms that are used in describing and naming limestone and dolomite. With the great advance in knowledge about these rocks, resulting mainly from studies associated with the occurrence of petroleum in reefs and limestone banks, the body of nomenclature is expanding constantly. Contributing to the proliferation, but not without "mixed blessings," are investigations of ancient rocks, modern sediments, environments of deposition, dolomitization, mineral species, grain-sizes, fabrics, and diagenetic processes.

The subcommittee will assemble these terms, dissect them, illustrate their important concepts, and publish the results. By means of the illustrations to accompany the final report, the subcommittee hopes to consolidate the best contemporary ideas and at the same time prevent further confusion and synonymy in this highly complex family of petroliferous rocks.

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Consolidation Characteristics of Sea-Floor Sediments

Twenty-seven laboratory consolidation tests were made on predominantly silty-clay sediments from eight Atlantic cores, two Mediterranean cores, and two Pacific cores from the continental slope, rise, and deep-sea floor. Values of the coefficient of consolidation, determined over the pressure ranges of 0–0.05 and 8–16 kg./cm.^{2}, ranged from 2×10^{-4} cm.^{2}/sec. for the lower pressures to 34×10^{-4} cm.^{2}/sec. for the higher pressures. Compression indices computed from the relationship of the void ratio to the logarithm of pressure (e log p) ranged from 0.3 to 1.5.

Results of these tests show that the strength characteristics of sea-floor sediments are dependent upon the environments of deposition. Deep-water sediments generally are stronger than expected (they are "overconsolidated"). Evidence supporting this generalization, in addition to the consolidation data, is demonstrated by (1) the computed ratio of shear strength to effective overburden-pressure values (c/p) of about one to four, which are appreciably higher than the normal values of 0.2-0.4, and (2) the relatively small reduction of porosity with increasing depth below the water-sediment interface in homogenous sediment. The explanation for the observed relationship of deep-sea sediments exhibiting characteristics of overconsolidation is found in the very slow rates of deposition, great age, and the presence of appreciable amounts of clay minerals, volcanic detritus, and siliceous (Radiolaria) and calcareous (Foraminifera) biogenous matter. It is postulated that solutions of these materials in the sediments may yield iron, manganese, silica, and calcium carbonate that, together with the clay minerals, result in a kind of interparticle bonding having the effect of cementation, although actual cementation is not visible. These cementation effects are believed to be the cause of strengths greater than those expected.

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Computer Simulation of Marine-Organism Community Environments

Computers can be used to re-create the behavior of ancient marine-organism communities with surprising effectiveness. Organism communities and their environments have been represented symbolically in a three-dimensional mathematical model embodied as a series of computer programs for IBM 7090/7094 computers. Factors affecting environmental conditions, such as depth of water, distance from shore, water turbulence, deposition of sediment, and salinity, can be adjusted by changing the numbers fed into the