commonly occur at basement, at shale-limestone interfaces, at faults, etc. Provided that the geometry of the structure is simple enough and that adequate conductivity contrasts exist, measurements can be interpreted in terms of structure. Hence, one can outline basement depth in a sedimentary basin, measure depth to weathering, or delineate a fault by telluric current methods.

The measurements can be made in a number of different ways, among which are the telluric, magneto-telluric, and wave-tilt techniques. Several of these are being actively studied by various research groups. Instrumentation depends on the depth of investigation desired, as well as on the technique used, but seems to present no fundamental problems for exploration applications.

The major problems at the present time are analyzing and interpreting the measurements. Anlaysis (filtering) is now being done in a routine fashion by digital computers, but could be done electronically. Interpretation techniques at present allow at least semiquantitative depth estimates (±10%) and can possibly be refined to enable greater accuracy.

Results of our magneto-telluric measurements in areas of well-known geology show that reasonable information can be obtained by rather brute-force interpretation techniques.

WALPER, JACK L., Texas Christian University, Fort Worth, Texas

Basement Control in the Structural Evolution of Southern Oklahoma

Southern Oklahoma comprises a complex of structural elements that can be related to recurrent movement on a system of basement faults that had its origin at the time of consolidation of the crystalline basement. Repeated trans-current movements, accompanied by uplift of horsts and deep subsidence of adjacent grabens delineated by this major fault system, have exerted a profound control over the stratigraphic and structural evolution of southern Oklahoma.

The larger faults, the Meers fault of the Wichita Mountains, the Washita Valley and Sulphur faults of the Arbuckle Mountains, and the Choctaw fault of the Ouachita Mountains dominate the minor faults and delineate the major basement blocks, namely, the Wichita block, the Tishomingo-Belton uplift, and the frontal edge of the Ouachita Mountains and the intervening basins. The interplay of these basement controlled blocks and their adjacent grabens has not only influenced sedimentation by establishing the pattern of basin development but they controlled the magnitude and type of tectonism that has occurred throughout the Paleozoic Era.

Transcurrent movement, according to the wrench-fault mechanics of Moody and Hill, on the major faults which border the basement blocks has produced the stress field responsible for the structural complexity produced during the several stages of the orogenic climax in late Paleozoic time.

WEBER, JON N., The Pennsylvania State University, University Park, Pennsylvania

Oxygen Isotope Ratios in Fresh-Water Limestones as Sensitive Paleoclimatic Temperature Indicators

Oxygen-18/Oxygen-16 ratios of marine limestones and calcareous organisms have been widely applied to the determination of water temperatures of ancient oceans after the technique was developed by Urey et al. The use of the carbonate paleogeothermometer has not been extended much past the Cretaceous because of uncertainties in the oxygen isotopic composition of pre-Cretaceous seawater and because of the possibility of isotopic exchange between marine carbonates and isotopically lighter intrastratal fluids.

Freshwater limestones and fossils have not been used for paleotemperature determinations because of the great variation in the O^{18}/O^{16} ratio of the water in which these carbonates were precipitated. Such variations arise from differences in latitutde and altitude at which meteoric precipitation of water took place, the origin and history of the air mass, and the extent of evaporation of stream and lake water. Duplicate isotopic analyses of 157 proven fresh-water limestones of Devonian to Quaternary age which were formed in large bodies of water, excluding saline lakes, and which show no signs of isotopic alteration, suggest that the variation is random and that a large number of samples may provide a mean δO^{18} value which is temperature dependent. Mean δO^{18} values are: Devonian (−8.57), Pennsylvanian (−5.25), Permian (−4.36), Triassic (−5.12), Jurassic (−8.52), Cretaceous (−10.22), Tertiary (−9.65), Quaternary (−8.15), in permil, relative to the Chicago PDB standard. The results form a regular sinusoidal curve with O^{18}/O^{16} maxima in the colder periods of Permo-Caboniferous and Quaternary glaciation, and a minimum for the Cretaceous. Large bodies of fresh water, because of a greater response to worldwide temperature fluctuations than the oceans, form limestones whose isotopic composition may yield significant paleoclimatic information in the form of relative climatic temperatures.

WILSON, H. D. B., Department of Geology, University of Manitoba, Winnipeg, Manitoba

Composition and Structure of the Keewatin Volcanic Rocks

Approximately three hundred Keewatin volcanic rocks have been analyzed from nine greenstone areas in the southern part of the Superior province. Basalt-andesite-dacite-rhyolite series are typical of each area and indicate a continental orogenic origin. The non-spilitic composition of the lavas confirms the continental orogenic origin rather than volcanism during accumulation of geosynclinal material.

A regional study of the volcanic areas shows that each area is merely a part of a great volcanic province instead of a series of subparallel volcanic belts. The present state of the volcanic formations is related to the depth of the granitic crust, to the intrusion of granite diapirs, and to major slip folding involving the volcanic series.

The continent was present before the Keewatin volcanism. The earliest known rocks of the Shield consist of a series of sedimentary rocks, possibly 20 km. thick, from which the Kenoran granites were derived by crustal melting.

WINDER, C. GORDON, Department of Geology, University of Western Ontario, London, Ontario, Canada

Conodont Distribution in a Middle Ordovician Limestone

A 59-foot section of the upper Cobourg formation (upper Middle Ordovician) at Colborne, Ontario, was sampled at 2-foot intervals without regard to bedding. The limestone is thin-bedded biomicrite and biosparite, with the latter occurring consistently only in the lower two-thirds of the section. Although the −40 +140-mesh insolubles increase slightly toward the top, the allogenic "heavies" are more abundant in the top and bottom third than in the middle. Some microfossils such as brachiopods, gastropods, and sponge spicules have different abundances in the lower and upper part of the section. Approximately 3,500 conodonts, assigned to 27 genera, vary in concentration from less than 2 to more than 200 individuals per 100 grams, with the average about 40. However, exceptionally low concentrations are adjacent to exceptionally high. The moving averages of both concentrations and numbers of genera show a decreasing trend toward the top of the section. The different conodont elements—that is, cones, compound, and platform types—show a stratigraphic variation per sample for concentration in the rock and percentage of total fauna, suggesting that some types were carried by different animals. Stratigraphically, the distribution of certain genera seem to show a relation to the occurrence of the biosparite, the heavy minerals, and other microfossils. The trends and variations in the Colborne quarry are probably local, but the relation between petrographic and paleontologic factors suggests that environmental conditions probably controlled the conodont distribution.

ZARRELLA, W. M., AND EARLEY, J. W., Gulf Research and Development Company, Pittsburgh, Pennsylvania

SIGNIFICANCE OF HYDROCARBON DISPOSITION IN PETROLEUM EXPLORATION

Organic matter occurs ubiquitously in the geological column, but the occurrences of commercial petroleum accumulations bear a relation to types and amounts of hydrocarbons found in equivalent rock strata. The distribution of organic carbon in a sedimentary rock unit, as well as in recent sediments, varies both vertically and lateraly and appears to be dependent on parent material, lithology, environment of deposition, and post-depositional processes. Clays deposited in a near-shore marine environment exhibit a high organic carbon content. The Mowry shale of Lower Cretaceous age in Wyoming has an organic matter content which reaches a maximum in an area where sediments are thought to have been deposited in a relatively shallow marine environment. The frequency of occurrence of oil fields in the Lower Cretaceous in the general area where the content of organic matter is high, and the enhanced concentration of hydrocarbons in sand lenticles in the Gulf of Paria sediments (Kidwell and Hunt, 1958) suggest that a portion of the petroleum generated in a source rock can be and is accumulated in close proximity to the locale of petroleum generation. The chemical constitution of Cretaceous crude oils from the Clearwater group on the eastern flank of the Alberta basin and from the McMurray sands at Athabaska strongly indicates the correlation of these petroleums, suggesting an equivalent source, probably Lower Cretaceous shales. Although there is considerable evidence for lateral migration of petroleum, crude oil correlation studies suggest that vertical migration is restricted, except possibly along fractures in the rock system. This view is further supported by consideration of the variations in benzene concentration around an oil pool. There is abundant evidence for mgiration of benzene several miles laterally, but vertical migration through overlying fine-grained competent rock is negligible. It is clear from the composition, properties, and distribution of organic matter that oil pools do not occur randomly in the subsurface, but, rather, they occur in those parts of the geologic column where petroleum has been generated, where reservoir rocks are available, and where suitable trapping conditions exist.

From considerations of the disposition of organic matter in a rock system, it should be possible to determine quantitatively the amount of petroleum generated in a given rock unit and which parts of the geological section are most likely to be productive. More directly, the types and amounts of hydrocarbons and their distribution in the subsurface can be used to evaluate the existence of an undiscovered oil pool.

MEMBERSHIP APPLICATIONS APPROVED FOR PUBLICATION

The executive committee has approved for publication the names of the following candidates for membership in the Association. This does not constitute an election but places the names before the membership at large. If any member has information bearing on the qualifications of these nominees, he should send it promptly to the Executive Committee, Box 979, Tulsa, Oklahoma 74101. (Names of sponsors are placed beneath the name of each nominee.)

FOR ACTIVE MEMBERSHIP

Aharoni, Efraim, Tel Aviv, Israel
(Joseph Coates, Walter Randall, Moshe Goldberg)
Atamanchuk, Wilfred Ernest, The Hague, Netherlands
(John P. Walsh, James Crawford Parry, Gerald W. Fuller)
Conway, Horatio Joseph, Tyler, Tex.
(Robert W. Eaton, Wynne M. Adams, John G. Voight)
Cullins, Henry Long, Denver, Colo.
(N. Wood Bass, Keith A. Yenne, George H. Horn)
Gnagy, Laurence Earl, Midland, Tex.
(Joseph C. Carl, William B. Newberry, H. David Pennel)
Harvill, Robert Sebran, Jr., Corpus Christi, Tex.
(Walton S. Launey, Charles W. Holcomb, Harold W. Owens)
Hentz, Max Ferdinand, Tripoli, Libya
(John P. Walsh, James Crawford Parry, Jack Wild)
Kellogg, Harold Eugene, Tripoli, Libya
(Hugh D. Klemme, Allan S. Westerholm, Marshall Kay)
Kent, Bion Huntley, Lakewood, Colo.
(Thomas A. Hendricks, G. P. Salas, Ralph L. Miller)
Lyons, Percy Marvin, Lafayette, La.
(James H. Morris, Adam M. Sturlese, Jay B. Wharton, Jr.)
McCaffrey, Richard Joseph, Denver, Colo.
(John O. O'Brien, H. Bruce Tiffin, Robert E. Folinsbee)
Nelson, Rex Woodrow, Jr., Houma, La.
(Russell H. Nordwell, Richard D. House, Harold Sorgenfrei, Jr.)