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ciently certain for incorporation into a Moonwide stratigraphic system.

The absolute length of the periods can be estimated only crudely. An assumption that the majority of craters are of impact origin allows the spatial frequency of craters on surfaces of different ages to be compared with the flux in space of potential crater-forming objects and the spatial frequency of presumed impact structures on Earth. Such comparison suggests that, if the present rate of flux prevailed through the Copernican and Eratosthenes Periods, these periods occupied the greater part of time since the origin of the planets. If so, the pre-Imbrian and Imbrian must have been periods of short duration during which the rate of impact of crater-forming objects exceeded that in subsequent time.

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November 9, 1964

W. M. HAAS, Humble, Houston

"What Is Our Geologic Image?"

The image the geologist portrays to the public is generally indistinct. Few people have a clear understanding of the geological profession and its contributions to society. The capabilities, talents, and potential leadership of the geologist are generally overlooked. The image must be brightened by aggressive actions. The public should be informed and educated to the qualities of the geologic profession. Students need to be encouraged to study geology; to recognize that geology as a science is not only rewarding as an avocation but also as a vocation; that the economic geologist has almost unlimited opportunities to advance his ambitions.

During 1966, the Semi-Centennial Year for the American Association of Petroleum Geologists, petroleum geology will be publicized. Through its theme "Petroleum Geology—The First Fifty Years" the public will be informed on the contributions that petroleum geology has made to mankind. Both national and local publicity campaigns will take the geological message to the people in an effort to enhance and enlighten the geologic image.

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November 16, 1964

D. M. TRIPLEHORN, Sinclair Research, Tulsa

"Origin and Significance of Glauconite in the Geologic Sequence"

Glauconite is defined as any sand-sized, earthy, greenish pellet found in sedimentary rocks. This definition has no specific implication regarding chemical or mineralogical composition. However, most glauconite pellets are composed primarily of a randomly interlayered 10-Angstrom non-expandable (illitic) material and expandable (montmorillonitic) material. Much of the variation in glauconite properties is related to variation in the amount of expandable layers present.

Glauconite pellets reveal much variety in external appearance (morphology) and internal structure (as seen in thin section). These characteristics can be used to interpret the origin and/or subsequent history of pellet types. Suggested origins include (1) chemical precipitation, (2) expansion and alteration of detrital mica, (3) alteration of fecal pellets, (4) alteration of clay fillings of fossil tests, (5) mechanical aggregation, and (6) chemical replacement. Original morphologies may be obscured by abrasion (reworking) and internal structures changed by recrystallization.

Glauconitization apparently requires four essential factors: (1) parent material (generally an expandable layer lattice silicate), (2) a source of iron and potassium (sea water), (3) local reducing conditions, and (4) time. The last factor emphasizes the progressive nature of glauconitization, which may be terminated at any stage (most likely by burial).

The progress of glauconitization results in certain interrelated changes in glauconite pellets:

(1) An increase in iron and potassium, (2) a decrease in the amount of expandable material, (3) an increase in crystallinity (degree of ordering), (4) a change from light green to dark green color, and (5) an increase in rounding and sorting of pellets. There are only general trends and exceptions may be common.

Glauconite is a reasonably safe criterion for a marine, shallow water environment and slow rates of deposition. It is most abundant at unconformities; e.g., at the base of marine transgressive sequences. Redeposition in terrestrial environments is unlikely. Transportation of glauconite after its formation inhibits its use as a more specific environmental indicator on a simple presence or absence basis. However, since glauconite occurrences differ in kind of and variety of pellets, recognition of pellet types and their distribution is potentially useful for stratigraphic correlation or environmental determinations.

Glauconite is the only clay material occurring in sedimentary rocks which is known to be authigenic in origin, is abundant, and is relatively free from impurities. Thus the geochemistry of glauconite should be a fruitful area of study. At present, most of the emphasis has been restricted to age-dating aspects, but there are numerous other possibilities.

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November 23, 1964
DAVID A. SIX, Midwest Oil, Fort Worth
"Pennsylvanian-Atoka Producing Sands, Red Oak-Norris Gas Field, Arkoma Basin"

The Red Oak-Norris Gas field was the first of several recently discovered fields in the deeper part of the Arkoma basin which produces gas from the lower Atoka Spiro sand. However, this field is also capable of producing gas in large quantities from sands of lower-upper Atoka (Fanshaw sand) and upper-middle Atoka (Red Oak and Panola sands).

Not only is the Red Oak-Norris Gas field the largest single gas producing field in areal extent and reserves discovered in the deeper part of the Arkoma basin to date, but it is believed that it is also the most complexly faulted. Overthrust faulting from the south as well as normal down-to-the-north faulting are in evidence. Considerably more is to be learned concerning the geology of this field as continued development progresses along the north flank. Additional subsurface control is needed in this area in order to fully evaluate the areal extent of the Fanshaw, Red Oak, Panola and Spiro sands. Difficulty has already been encountered in making sand depositional studies along this flank which can only be ascertained by the drilling of additional wells.

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November 30, 1964
DAN E. FERAY, Texas Christian Univ., Fort Worth
"Tectonic and Environmental Factors in Sedimentation"

Ancient sediments (sedimentary rocks) are interpreted in light of evidence available from the examination of modern processes based upon the concept of uniformitarianism. Recent sediments models of the Bahamas, Florida Keys, Mississippi Delta and Northern Gulf of Mexico are reviewed as to their application to the interpretation of ancient sediments deposited in geosynclinal and stable shelf areas.

Puerto Rico, being in an area of active tectonic uplift and subsidence, demonstrates a variety of environmental conditions of diastrophism, physiography, and climate related to a variety of sediment types including graywackes, subgraywackes, arkoses, fine grained terrigenous clastics, bioclastic limestones, reef limestones, carbonate muds, and evaporates all in various facies relationships. Sources of sediments involve an orogenic belt of plutonic, volcanic, metamorphic and sedimentary rocks ranging in elevation from sea level to 4000 feet above sea level. The climate of the source area varies from tropical rain forest to desert. Depositional sites include fluvial, bay and lagoonal, littoral margin dunes, deltas, shelf basin-bank-reef complex, slope, and abyssal environments. The facies relationships between terrigenous clastics and carbonates provides a Recent sediment model of great significance when applied to evaluation of ancient sediments.

The sedimentary rocks of Pennsylvanian age in north-central Texas consist of a sequence of conglomerates, sandstones, shales and limestones exhibiting facies relationships representing fluvial, deltaic, lagoonal, littoral, and shelf environments of deposition. The shelf sediments involve both carbonate banks and reefs in a terrigenous clastic sequence. The effects of sea-floor topography on sedimentation are significant both in regard to type and thickness. Evidence of deep water or continental shelf-slope relationships are absent indicating deposition of sediments in a subsiding shelf environment.

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December 7, 1964
ERNEST W. SHAW, Imperial Oil Enterprises, Calgary
"Canadian Rockies Orientation in Time and Space"

The Canadian Rockies are located between the Rocky Mountain trench on the west and the edge of the disturbed belt on the east; to the north they plunge out near the Yukon-British Columbia boundary and to the south they extend over 150 miles