in both cores, suggesting some diagenetic effects after burial of the sediments and organic remains, rather than a direct relationship with foraminiferal and ostracodal populations.

Foraminifera, Ostracoda, spores, and pollen are present in both cores. In addition, the core from Matagorda Delta contains hystrichosphaerids and the core from Galveston Bay contains diatoms.

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Biological and Ecological Information from Physical and Chemical Properties of Skeletal Carbonates

Progress has been made in relating physical and chemical properties of carbonate skeletons to physiologic and ecologic factors in Recent marine organisms.

Data are accumulating which show that the skeletal mineralogy and its chemistry may change significantly in an individual during growth. Discrete microarchitectural units of individual skeletons may differ widely in mineralogy and chemistry because of differences in the biochemistry of the tissues which deposit them. Investigations of shell regeneration show that the mineral species of the skeletal-repair carbonate is the same as that in normal growth, but there are differences in trace element concentrations. These data emphasize the need for differentiating the various physiological effects on skeletal carbonate deposition within and between species.

A number of ecologic factors are known also to affect the morphology, mineralogy, and chemistry of skeletal carbonates in many species. Consideration is given to the current status of our knowledge of the specific effects of each individual ecologic factor and of distinguishing these from physiologically controlled effects.

Application of these approaches to paleoecological investigations requires criteria for distinguishing diagenetic changes, possible evolutionary changes in mineralogy and chemistry, and physiologically and ecologically controlled effects.

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Geology and Geophysics of the Gulf of Mexico

The geophysical data on the Gulf of Mexico, combined with the known geology, make possible the preparation of a number of maps which define the modern geosyncline and provide some evidence as to its inception. The velocities and depths of interfaces observed in seismic reflection and refraction profiles reflect the characteristics and thicknesses of the layers of rock in the syncline, and the gravity and magnetic data indicate its tectonic framework. The inception of the geosyncline appears to be related to widespread collapse in Triassic time, which had been preceded by the deposition of Paleozoic sediments and the possible extension Gulfward of the Appalachian orogeny. The problems dealt with in this paper are: (1) the shallow Jurassic and Cretaceous aspect of the Gulf, (2) the widespread extent of the salt and the resultant domes, (3) the lateral or wrench faults and the restoration of transposed elements, (4) the pattern of shifting depocenters, (5) the tremendous acceleration of depositional rates in Tertiary time culminating in the rapid present day rate of 24.4 cm/century determined by Hardin and Hardin, (6) the enigmatic Atlantic trench, (7) the unexpected axial directions of magnetic anomalies, and (8) the intermediate (between continental and oceanic) depth of the Moho below the Gulf. The cumulative result of the complex history is a Mesozoic and Cenozoic geosyncline with a sedimentary thickness of perhaps 60,000 feet. The final problem is why this great prism of rocks does not fold into a mountain range after exceeding the accepted depth limit for other geosynclines.

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Gravity Interpretation of Major Crustal Properties and Mass Distribution

Great anomalies, usually regarded as "regional," clutter gravity and magnetic maps. These anomalies are removed in the process of isolating residual features that are significant as basement and (or) sedimentary effects. A study of these deep crustal features on detailed regional maps of Oklahoma reveals that: (1) each large gravity anomaly has a corresponding large magnetic anomaly, and (2) the most probable depth values calculated from selected large magnetic and gravity anomalies, assuming the same source (dense rocks rich in magnetite), show a surface, well below the top of the crystalline basement, which has considerable relief. The relief includes pronounced lateral displacements along faults, all east-west in trend. The most appropriate name for this surface is the "Algoman surface," the U. S. Geological Survey designation for the vast world-wide surface which reflects the great unconformity which followed the end of the Archean (early Precambrian). Prior to this time, it now appears, the earth had very little oxygen in its atmosphere, and minerals such as magnetite and uraninite, for example, escaped oxidation and were preserved below this Algoman surface. Widespread mapping of this interface has both tectonic and mining significance, because the positions of this surface near the present crystalline basement are commonly associated with mineralization. Speculatively, the folding of the "Archean" rocks and the relief of the Algoman surface may be in part a manifestation of great tidal movements prevalent if the orbit of the moon, projected back 2.5 billion years, was much closer to the earth.

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The Hockingport and Waynesburg Sandstones (Pennsylvanian and Permian) of the Dunkard Group

The Waynesburg Sandstone, lower member of the Waynesburg Formation, Dunkard Group (Pennsylvanian and Permian), has been considered to be a more or less continuous deposit extending entirely across the Dunkard basin. The true Waynesburg Sandstone is restricted in areal extent to southwestern Pennsylvania and northern West Virginia. A similar sandstone deposit, which exists in portions of Washington, Athens and Meigs Counties, Ohio, and adjacent West Virginia, has been considered to be a part of the Waynesburg Sandstone. In the opinion of the writers, these sandstones are not correlative. The sandstone of southeastern Ohio is herein termed the Hockingport Sandstone for the village of that name in Athens County.

The Hockingport Sandstone is a subgraywacke. It contains much pebble and granule conglomerate and averages 65 per cent quartz. The Waynesburg Sandstone is transitional between a subgraywacke and a protoquartzite, is locally conglomeratic, and averages 76 per cent quartz.

Both sandstone bodies are elongate, channel-fill, belt-type deposits of fluvial origin. The Hockingport Sandstone is a north-south oriented deposit up to 90 feet thick, blanketing an area of 225 square miles. The longer axis of the Waynesburg Sandstone is oriented N 20° E, the maximum thickness is 75 feet, and the preserved deposit blankets an area of 880 square miles. The grand mean of dip directions of cross-stratification readings of the Hockingport Sandstone is N 19° W and of the Waynesburg Sandstone, N 10° E.

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UPHEAVAL DOME, SAN JUAN COUNTY, UTAH

Upheaval Dome is a dissected domal structure that lies in the rugged "Canyon Lands" of southeastern Utah. Extensive canyon development within the dome's immediate area has produced remarkable exposures of the feature. It is surrounded by a distinct rim syncline and piercement is much in evidence within the dome's central portion; the area of deformation is approximately three miles in diameter and a vertical displacement of at least 1,200 feet exists at the feature's center. Strata that crop out within the domal area range in age from Permian to Jurassic, and all exhibit deformation by the forces that produced the dome. The area is underlain by some 3,000 feet of Pennsylvanian saline strata. The origin of the dome has not been proven, but the following hypotheses have been advanced: (1) it is a cryptovolcanic feature; (2) it was formed by meteorite impact; and (3) it is a salt dome (but there are conflicting views concerning the reason for salt intrusion at this specific site). An additional hypothesis for salt intrusion is advanced: Upheaval Dome is the product of salt intrusion resulting from differential compaction of the sediments lying above and on the flanks of a low conical hill on the Precambrian surface.

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CRETACEOUS STRIKE-VALLEY SANDSTONES, NORTHWESTERN NEW MEXICO

Cretaceous sandstone bodies, which are the principal oil reservoirs in the San Juan Basin, have been interpreted as offshore bars related to deposition of the regressive Gallup Sandstone. A detailed outcrop and subsurface study in the northwestern San Juan Basin indicates that these sandstone bodies are strike-valley sandstones in the transgressive marine "basal Niobrara" unit which rests unconformably on the Gallup Sandstone and older units.

Paleotopography of the pre-Niobrara unconformity consisted of northwest-southeast trending cuestas and intervening strike valleys with local relief of over 100 feet. Cuestas and valleys are related to the subcrop of alternating resistant and non-resistant units in the truncated sequence. Elongate, lenticular sandstone bodies overlying the unconformity occur in strike valleys on the northeast side of cuesta scarps. Individual sandstone bodies, with a maximum thickness of about 50 feet, lap out to the southwest against the cuestas and thin to the northeast by facies change to shale. Younger sandstone bodies extend progressively farther to the southwest.

Basal Niobrara sandstones are fine to coarse grained and glauconitic, and contain marine macrofossils. Interbedded and laterally equivalent shales also contain marine fossils, including both benthonic and pelagic forms. The sandstones are characterized by broadly lenticular sets (up to 6 feet thick) of high-angle cross-stratification. Measurements of cross-stratification dip directions at 20 localities indicate transport by currents flowing generally southeastward.

These sandstones are best interpreted as nearshore marine sands deposited in strike valleys on the seaward side of cuesta scarps during a general transgression to the southwest. During the transgression, cuesta ridges acted to stabilize temporarily the position of the shoreline, permitting accumulation of sand nearshore while clays were deposited farther offshore to the northeast. Transport of sand was largely in the form of underwater dunes migrating alongshore to the southeast.

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AN APPLICATION OF ELECTRONIC DATA PROCESSING TECHNIQUES TO PALEONTOLOGY AND STRATIGRAPHY

A method for electronic data processing of paleontological/stratigraphic information has been devised and is in operation. Through use of a species accession reference number, paleontologic, stratigraphic, and ecological data (including synonymies of species) can be collated to reveal essential information on a given form. In addition, retrieval can be effected through use of the genus and species names as a retrieval code, although this is a slower process.

A bibliographic accession reference number allows complete treatments of bibliographic data, including abstracts, faunal lists, and other important collateral information. This bibliographic accession reference number is added to the species index cards to effect a cross-reference and corollary check of data.

This system is in operation for the McLean Card Catalogue of American Foraminifera, the Card Catalogue of Ostracoda, and the H. S. Puri Card Catalogue of Recent Ostracoda, all of which are completely cross-indexed by the system. With minor modifications, the index can be used for museum types and collections; it will be used for numerous other applications. The basic file will be available, through mechanical reproduction, to anyone desiring to use it.

Electronic data processing methods will partially replace, and greatly augment, manual methods; but for most operations, manual searches will still be the most efficient method of retrieval. Computers are advised only for extensive searches and, periodically, to correct and arrange the files. The interpreted, mechanically reproduced file cards are efficient for manual use.

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GENERAL GEOLOGY AND HYDROCARBONS OF THE NORTHERN AMADEUS BASIN, AUSTRALIA

The Amadeus basin is a structural depression extending easterly from the Canning basin in Western Australia to the Great Artesian basin in Queensland. It covers about 80,000 square miles and contains up to 30,000 feet of late Proterozoic and early Paleozoic marine and continental sediments.

The marine cycle of deposition started in late Proterozoic time and terminated in late Ordovician. No unconformity is present at the base of the Paleozoic sequence and both Proterozoic and Paleozoic beds are unaltered except along the northern margin of the basin where low grade metamorphic facies were developed in